Editorial

ONE of the most interesting items of news during the month concerns the waning popularity of color TV in the United States.

As far as I know, color TV does not exist anywhere else except experimentally. But I cannot imagine a better place to try it out commercially than in America, with its avid acceptance of new things and its rapid reaction to them.

The history of color TV is very closely bound up with the activities of the Radio Corporation of America, and its colossal effort to achieve this modern miracle. Even when the FCC gave its premature blessing to the CBS color-wheel system some years ago, RCA merely dug in its heels and reiterated its faith in the electronic method. By doing ten years work in two it produced a tri-color picture tube, now considered to be the only satisfactory color medium in sight.

It has announced its intention to persevere, "going it alone" if need be until the proposition becomes a practicable one.

In the face of this confidence, and the vitality behind it, lack of public acceptance is a poser.

The only obvious explanation seems to be that color is here before we are ready for it.

I believe quite firmly that eventually every form of picture presentation must include not only color but 3-D as well. John Logie Baird expressed this view to me nearly 20 years ago, when TV was a crude thing. He said that eventually TV would be displayed in color and full stereoscopic presentation. That's the way we see things in real life.

In a recent lecture in Sydney, Mr. J. E. Benson, one of our leading TV engineers, compared the achievement of color TV with that of the atom-bomb as one of the most amazing developments of modern times.

Perhaps this is the clue. It is amazing, and it is at least three times as expensive as the normal system. Maybe it is too early for the public to pay more for a better system, when the initial impact of the cheaper and easier method has not been absorbed.

The efforts of RCA may have brought us color TV before its time. A simpler method may be essential before it finds full acceptance. But no matter how long delayed, some day it will come.

John Moyle

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RADIO TELEVISION & HOBBIES

A NATIONAL MAGAZINE OF RADIO, TELEVISION, HOBBIES AND POPULAR SCIENCE

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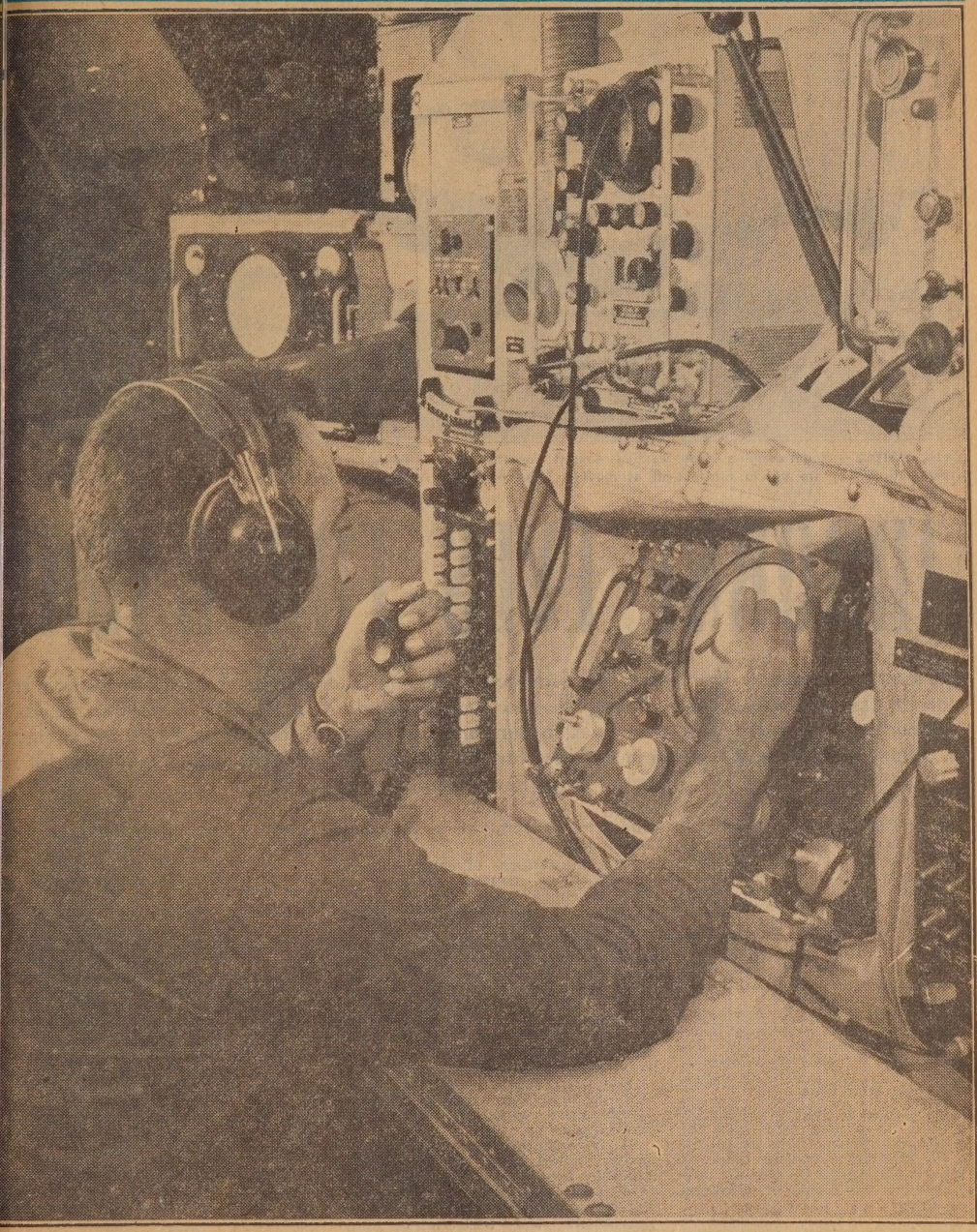
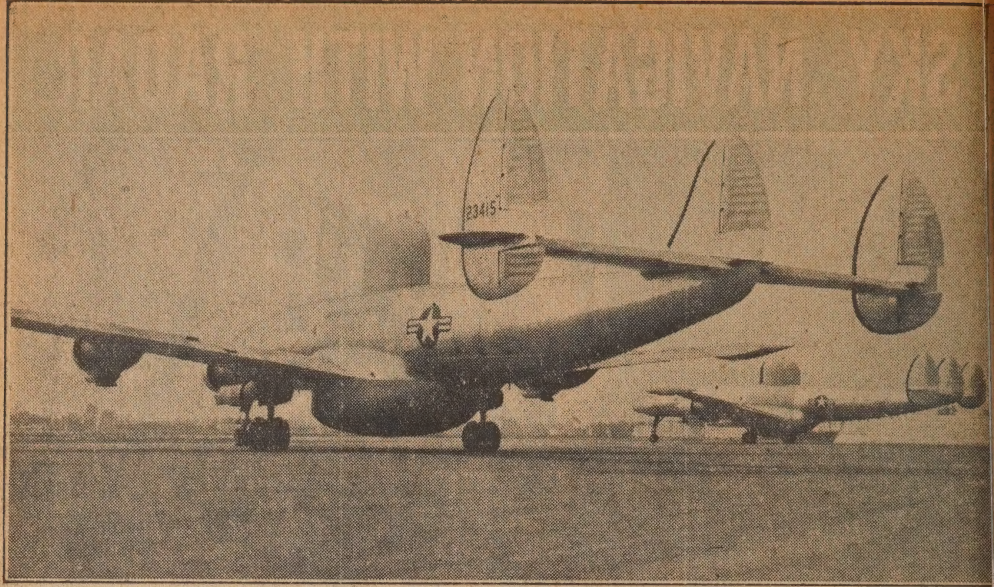
OUR COVER PICTURE—No man from Mars, but a process worker removing radio-active dust in a contaminated area of Britain's Hartwell Atomic Energy Establishment. He wears a plastic suit, and his "cleaner" is loaded with special replacable filter units. Over 80 of these machines are in use.

SKY NAVIGATION WITH RADAR



THE BIG PICTURE — Here is the heart of the radar plane's electronic warning and control system. Sitting at a master radar scope, the Combat Information Officer coordinates search work of his corps of radar observers and directs the over-all operation. With his equipment and backed up by a well-schooled crew of assistants he keeps track second-by-second of unidentified or "enemy" crafts' movements and directs the flow of reports on their manoeuveres to defending ships, planes and ground stations.



TWIN SISTERS — Radar-carrying early warning aircraft for the U.S. Air Force (left, designated RC-121) and U.S. Navy (right, designated WV-2) are poised for take-off as modern "Paul Revere" versions of the well-known civil Super Constellation.

AIRBORNE EYES FOR RADAR

The story of radar is the history of a miracle in human ingenuity which came to fruition in time to save the Allied cause during the dark days of World War II. Born in silence and developed in utter secrecy, it gave eyes to our forces. It enabled them to frustrate the enemy in defence and to seek him out in darkness for the attack. Without its help, the British Isles might easily have been overcome.

ALTHOUGH the secrets of radar in those early days is a secret no longer, modern equipment has reached a unique peak of perfection not only in the design and manufacture of the radar sets themselves, but their tactical employment.

Much of this employment has no direct relationship with war, unless the safety of aircraft and ships at sea can be considered as always having a bearing on war.

Today, radar aids to navigation are commonplace in both these fields. Suitable equipment is made and manufactured all over the world.

ESSENTIAL DEFENCE

But a nation's defences must be developed no matter how rosy the international scene. This is inevitable, as the giant strides made in the speed and range of aircraft, and the potency of modern weapons, races ahead.

Radar was initially designed to provide early warning of air raids when it was realised that the first attack in modern war would come from the air. Despite the many other uses for it, this early warning has remained a first requirement. The demands on the speed and accuracy of its work have never ceased to grow.

The importance of early warning of attack is, in fact, so important that it could easily win or lose a war by its effectiveness or otherwise.

The terrific destruction made possible by weapons such as the hydrogen bomb could easily mean that, if an enemy were permitted to strike a first effective blow, there might be little left for us to defend. Or, at best, industry and society could be so frightfully crippled as to make retaliation ineffective or impossible.

For this reason, speed and range are perhaps the primary requirements upon which a modern defence radar is built.

It is essential that the defence forces should know at the earliest possible moment of an imminent attack, the position of the threatening forces and the direction of their movement. Only then can be planned the best possible deployment of countermeasures to render the attack impotent at the earliest possible moment, and at the greatest distance from our shores.

To this end, every refinement of radar and allied techniques are assembled and co-ordinated, and th information they supply integrate to give the necessary answers wit complete accuracy immediately the are obtained.

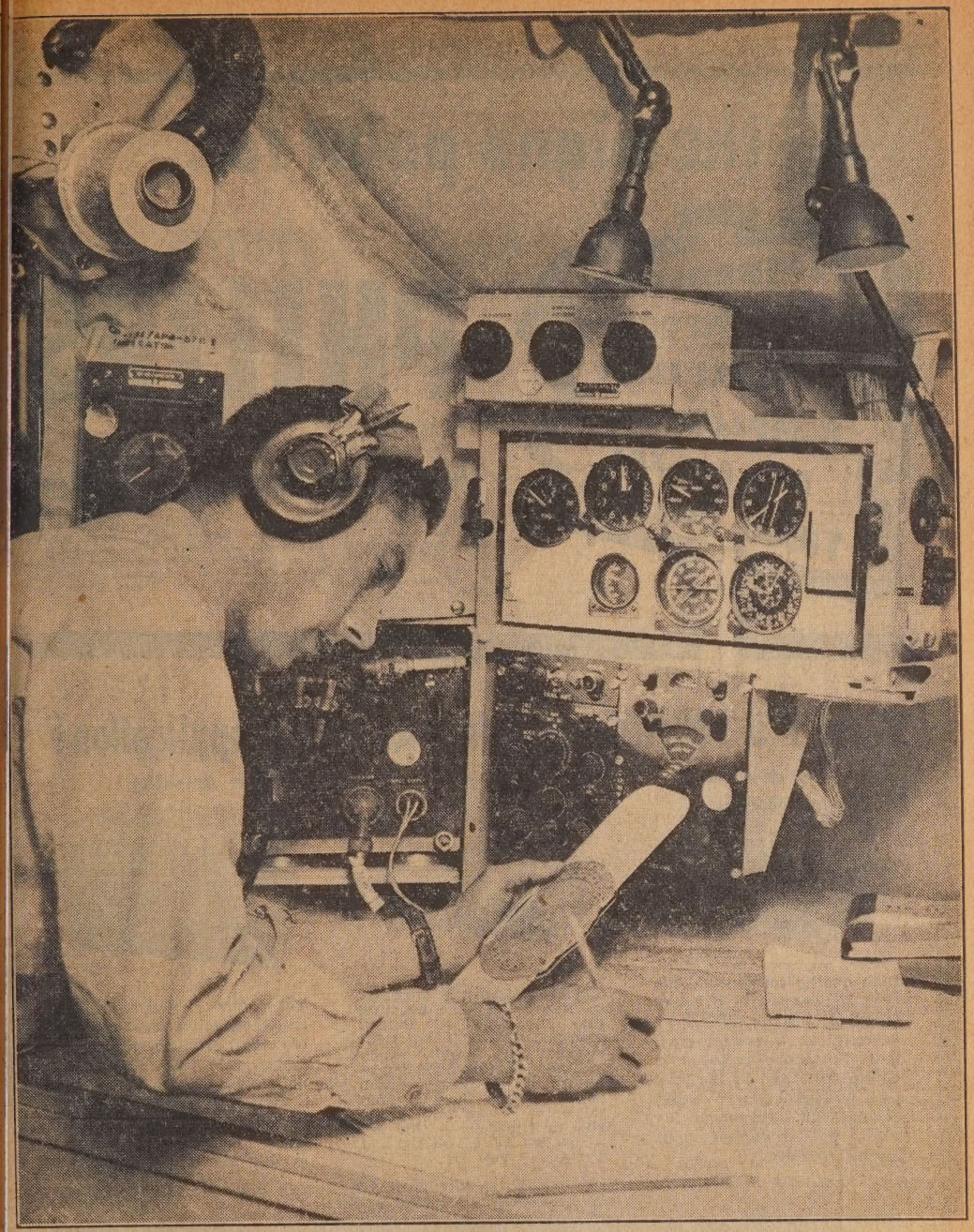
Even at the end of the last wa this principle was recognised in th development of radar stations whic were virtually a nest of many equip ments, each designed to do its ow particular job of range-findin height-finding, speed estimation an so on.

RESULTS COMPUTED

From these equipments, informa tion in the form of electrical sig nals was fed into a system of com putors, which co-ordinated and di gested them much more readily tha could be done by human means.

One great installation of this typ was able to set up an electroni eye which could literally see th movement of any object over a dis tance of hundreds of miles. Severa of them acting in concert were suf ficient to give ample warning fo defence forces to take appropriat action.

Only last month it was announce that Sydney was being given a rada



HENRY THE NAVIGATOR SKY-STYLE — Where were we at when we saw what we see? This man makes a running plot of radar plane's position throughout the entire flight in order to provide C.I.C. (Combat Information Centre) officers with quick reference points in intelligence reports to command posts and operating units in the area.

centre for defence which would cost £1-million.

But, during the last ten years, the picture has changed, and the greatest change has been in the matter of speed.

Early warning is measured in time, and time in its turn is important only in terms of the enemy's ability to get from its base to the target.

If since World War II aircraft speeds have increased three times, then the usefulness of the period of warning has been reduced by two-thirds of its original amount. Other factors have probably decreased the safety margin even further, so that the urge to increase the range and accuracy of the warning system is very great.

The main restriction on radar

All the signs point to...

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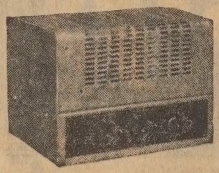

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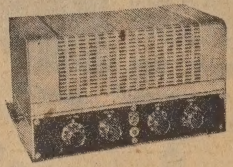

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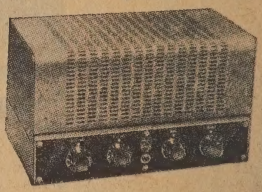

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nge is the so-called "line-of-sight" ect, which in general limits the dar beams to little more than e distant horizon.

Siting the early warning stations high ground, and even on moun- n tops near the shore, is a great lp. The big problem is to extend e line of electronic vision further an that of the land based stations.

One solution which is now being ken into practice in America is to uip large aircraft with an elabor- e radar system, which can do vir- ally the same work as the stations land.

If these aircraft are sent out at great height, they can extend radar nge by a double amount. They n look backward over hundreds miles to the parent station on ore, and at the same time search ead for possible targets by an ual distance, reaching to the limits their own greatly extended hori- n.

Technically, the task is not diffi- lt, but the work of designing and stalling equipment suitable and ght enough to fit into even the ge aircraft now being built, is not easy.

The aircraft selected for the pro- ct, six Lockheed Super-Constella- ns, are each required to carry six ns of electronic gear, in addition an operating crew of 31 trained en.

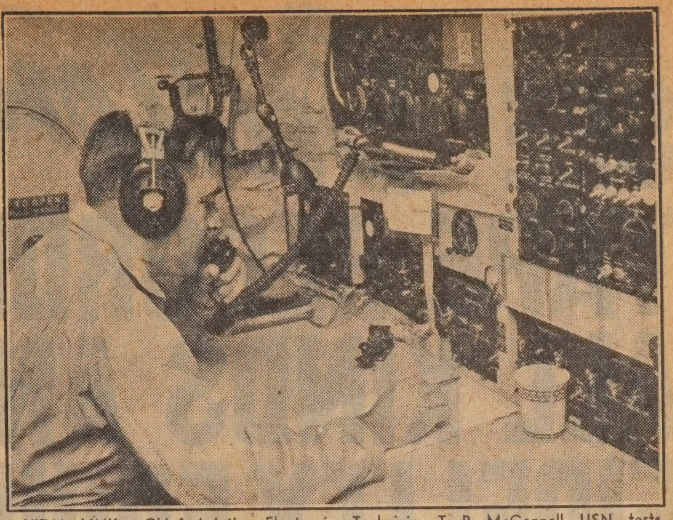
ONSTANT WATCH

This crew is designed to keep a und-the-clock watch. The aircraft ed back to base all the informa- on they can gather about possible truders, weather conditions and so n, and receive co-ordinating in- ructions from the base and from her stations in the defence net- ork.

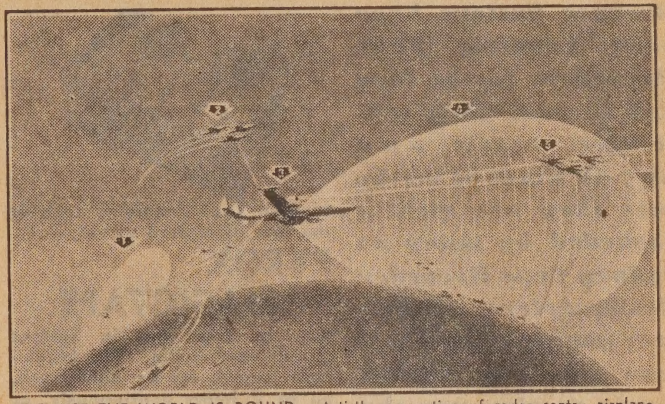
In their sentry work, they are ssisted by other units, some of them aval vessels, and some of them her aircraft. They are distinguish- d by special, range-extending wing- p fuel tanks, and strange, stream- ned protuberances which carry the icrowave directional aerials.

All this can only be done through he highest degree of training and perating skill by the men who man his miracle load of electronic magic, uch of which is among the na- on's best guarded secrets.

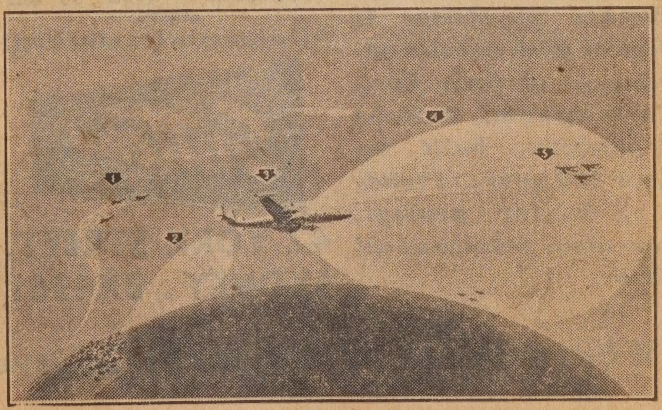
The pictures on these pages give me idea of the magnitude of the roject, the complexity of the gear, nd the conditions under which the perators and crew must work. They lso show graphically how the air- orne radar eyes keep their watch, nd play their part in guarding the afety of those who sleep at home.



VITAL LINK — Chief Aviation Electronics Technician T. R. McConnell, USN, tests radio equipment and establishes communication with remote commands in order to flash alert to carriers, bases and fighter airplanes over a wide area. Defensive measures are geared to swing into action within seconds from alert.



BECAUSE THE WORLD IS ROUND — Artist's conception of radar sentry airplane in operation shows (1) ground radar limited by line-of-sight restrictions; (2) defending fighters moving to intercept invaders; (3) radar-carrying Super Constellation; (4) big sweep area covered by radar located in the saucer-like bulge beneath the airplane, with the aircraft's altitude permitting the radar to peek over the horizon; (5) 'invading planes' pinpointed in beam of the radar located in the "shark's fin" on top of the search plane.



AIR FORCE SENTRY OPERATION — Artist's concept of big radar picket plane in operation shows (1) defending fighters arising to the early-warning call of USAF RC-121; (2) ground radar, limited by horizon, in full operation to pick up any invaders that might penetrate the outer net; (3) radar Super Constellation sentry at altitude which permits peeking over the horizon; (4) huge search area covered by the powerful radar installed beneath the fuselage; (5) height-finder radar operating from the uppermost dome on the airplane.

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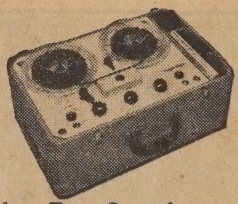

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THE FLYING DECKCHAIR STORY

the long, straight stretch of the rman Autobahn between Munich Ingolstadt, 22 world speed ords were broken by a new type motor cycle, driven by Gustav mm. Thirteen days later, April of this year, the machine crashed, ng its designer and writing finis a thrilling account of determination and success.

HIS is the story of the fantastic "Flying Deckchair", why and v it was designed and built, and the events which led up to its teoric and eventually tragic eer.

t is not without reason that all ilised countries have brought wn legislation controlling and as- ting motor traffic to flow smoothly er the highways. One cannot dis- ard the life and property of other ople, just "to get there fast".

Such legislation does not, however, clude the possibility of arranging eed trials. Record-breaking at- npts on certain sections of the ad, must be made at certain pre- termined times, when they are not ely to interfere with the regular affic.

ORE THAN COMPARISON

These trials are much more than st a comparison between vehicles different horsepower, or the skill the drivers. They are also a ugh proving ground for motors, res, brakes and construction.

Just as there are scientists, who e willing to take the risk of death, testing new preparations and medi- nes on themselves, there always ill be designers and drivers of otor vehicles willing to give their ves to prove the practicability of eir designs, or to break records. And nobody can forbid them to o so, provided they do not en- anger the lives or safety of others.

Gustav Adolf Baumm, a young raughtsman, wanted to improve the erformance of light motor cycles. his he would do without increas- ig the motor capacity, by lying the river flat on his back on his cycle, nd providing a streamlined enclo- ire for both.

OT NEW

In itself this was not a new or evolutionary idea. As far back as 939, there was talk about a "rac- ig cigar", designed by one, Koe- ig-Fachsenfeld, who claimed ex- ellent results from his experiments. mong other things, an air resist- nce value of only .12 was measured n his models.

Air resistance is one of the most mportant factors in the design of igh speed vehicles.

Resistance values for any particu- ar vehicle depend on the form, sur- ace, and speed of vehicles. As a asis of comparison, an air resist- nce value, Cw, of approximately 8. is given for old style cars with igh superstructure. Modern cars, vith streamlined, low bodies, bring this figure down to about .5 to .4.

The Volkswagen, now a familiar sight on Australian roads, has an air resistance value of .25, when fully closed up.

A very low and long, Italian car, in which the driver had to lay flat with his head forward, reached an all time low of .14.

Baumm, who joined the NSU motor works in 1951, proved to have constructional ability far above average in designing vehicles of the lowest possible air resistance.

The first tentative experiments along these lines were carried out about twenty years ago. Without increasing the available power, promising results were obtained in the streamlining of motor cycle bodies.

Eighty pc of the motor power is usually absorbed by air resistance on motor cycles. This power is wasted, and it took many years to recover these losses by streamlining not only the motor cycle itself, but also the driver. He became a built-in part of his cycle..

It goes without saying that air resistance was not the only difficulty

Easily lifted by a man, the Flying Deckchair, as it is popularly known, is shown with its designer-rider, Gustav Adolf Baumm. From this picture it is not hard to visualise, that the streamlined form has characteristics similar to modern aeroplane bodies.

t confronted designers. Motors also had to be improved give more power for the same cylinder size.

On the basis of these experiments, Germany broke world records in 1939. Soon afterward, Italy, with tly or wholly streamlined machines, pushed the speed its still higher. During the last few years, only a v attempts to break the record have been made with- : completely enclosing both machine and rider in eamlined capsules.

Motor cycle design has immensely benefited from result of these record-breaking attempts.

When, in April, 1954, NSU succeeded in equalling d breaking several world records, the motor cycle lustry began to get interested in this peculiar-look- g, but nevertheless sound design of Baumm's.

Its air resistance is less than .1, which comes very se to values achieved in present-day aircraft con- uction.

VO DIFFERENT MODELS

Two different models were built, one with a 50 cc gine, and the other with a 125 cc engine. Total gth was 12ft, with a wheelbase of 7ft. Overall width given as 21 and 23in and height 22 and 24in for the and 125 cc models respectively. Unladen weight r the two models is 160 and 240lb.

Such small weights could, of course, only be achieved self-supporting aircraft-skin construction.

Baumm had to overcome many difficulties. But, al- ough his first designs were rejected in 1951, he worked . He would not accept the apparent fact that a der had to sit on his motor cycle, as if it were a rse.

His first experiments were carried out on an Iron- g board and a rudimentary frame with two wheels, hich demonstrated that the idea of laying the rider his back was definitely practicable. Further experi- ents followed, and in March, 1953, he built his first cord-breaking motor cycle.

The trial runs were much better than expected. In e following year Baumm broke three records in the) cc class, and two in the 125 cc class on another achine built subsequently. In several instances he ubled existing record speed.

These records were obtained over short stretches om a flying start. However, they were sufficiently od to arouse interest all over the world.

HOTTED UP"

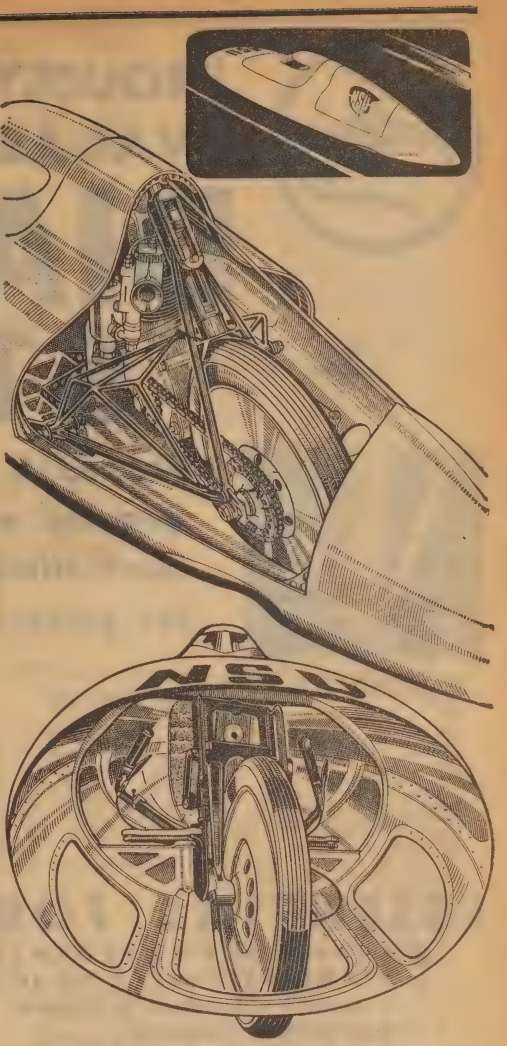
Needless to say, motors were very much "hotted p" for the trials. Nevertheless, the total power vailable from the 49 cc motor was only 3.4 hp at 7000 pm, and 7.2 hp from the 98 cc motor.

For the speed records this year, the available power as increased to 4.7 hp at 7800 rpm on the smallest otor. The special racing 125 cc motor delivered 16.5 p at 11,500 rpm.

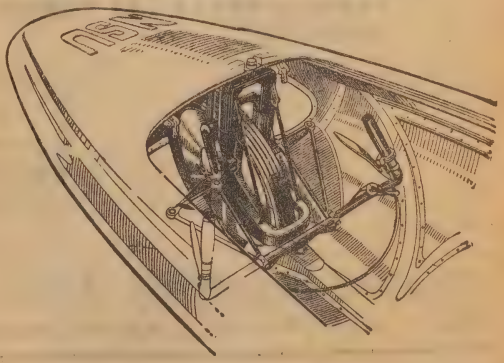
One hundred pc alcohol and 80-octane petrol were sed respectively, and this, together with improved otors and streamlined body, enabled a maximum speed f 136 mph to be reached.

On May 23, 1955, the machine crashed while on trial run on the Nurburgring, famous German racing ircuit. Baumm, who always rode the "Flying Deck- hair", as it was popularly known, was killed in the crash.

His death was a great loss to research, and the ractical application of engineering design in his own eld. As with so many other intrepid, fearless men, e paid the price for knowledge which can only be btained by testing the limits of achievement.—Orion.



Detail drawing shows the motor and drive (top), the front fork (centre) and the steering gear (below). The body is a self-supporting tubular "skin", on which are mounted the front and rear forks.



Sunlight into Electricity

SOME time ago it was reported that the Bell Telephone Co. has succeeded in producing sun powered batteries, which are strong enough to supply telephone repeater stations in remote areas, where conventional power sup- plies are not available or not practicable.

Technical details of their manufacture have now been released by the company.

For single cells, a solid single crystal of silicon is cut and polished with optical precision. Subsequently it is exposed, in high vacuum, to ionic bombardment with ions of 300eKV energy, at a temperature of 390 degrees C.

Subsequently, the polished crystal is coated with a 00025 mm thick layer of boron. So far, cells of 10 x 50 x .1 mm size have been manufactured. One square yard of cell area supplies approximately 50 watts of power, sufficient to run repeater stations or small transmitters.

X-RAY SHOWS ENGINE IN MOTION

Announcement of a system for "x-ray televising" the internal parts of an operating engine, was among the highlights of an Open House held at the National Bureau of Standards earlier this year. Dr. A. V. Astin, director of the bureau, explained the operation of this new scientific wonder.

DR. ASTIN illustrated NBS work in the x-ray range of the spectrum with demonstrations of the radiation monitor and the system for x-ray televising the interior of an engine.

The radiation monitor is a remote-control system which automatically measures radiation intensities in the vicinity of an atomic explosion and transmits the data by radio to a centrally located headquarters.

The system was developed at the request of the Division of Biology and Medicine of the Atomic Energy Commission for use in nuclear tests. Its overall design was worked out by L. Costrell and associates of the bureau's nucleonic instrumentation laboratory. As Dr. Astin explained the operation of the monitor, it received and recorded the background radioactivity level at a remote station near Reno, Nevada.

PENETRATING RAY

The x-ray televising demonstration used highly pentrating radiation from the beatron in combination with a technique recently reveloped at the bureau for converting high-energy x-rays into visual images.

The audience saw clearly the moving piston, piston rod, and other parts in a televised x-ray image of a small one-cylinder engine.

By means of this technique it should be possible to televise the internal operation of a wide range of mechanisms, such as automotive and aircraft engines, pumps, and other devices.

Because of their greater penetrating power and lower scattering, high-energy x-rays from betatrons and synchrotrons produce sharper images than do lower-energy x-rays, allowing the observation of greater detail and the detection of more minute flaws in metallic equipment.

However, until now their use in studying the internal operation of heavy machinery has been confined largely to x-ray photographs. Suitable methods for observing the interior of a mechanism while it operates have been lacking.

The bureau's system, developed by Dr. J. S. Pruitt of the NBS Betatron Laboratory, makes use of an instrument called a pattern amplifier, which acts as an x-ray intensifier, continuously detecting, amplifying and displaying low-intensity x-ray images.

The major component of the pattern amplifier is the converter—a large, cylindrical, thallium-activated sodium iodide crystal, which converts x-ray images into optical images.

When bombarded with an x-ray

(Continued on Page 119)

BATTERY OPERATED RADIOGRAM

The 7-inch 45 rpm records which are now well established have many advantages over their 78 rpm counterparts. Not only do they give more music from a smaller disc, but they are extremely light in weight. Being flexible, they will not fracture as easily as the older types.

Right — The battery operated radiogram which plays only 45 rpm records, using a motor with a power consumption of only 80 milliwatts.

WHEN considering a portable gramophone or radiogram these records would be an immediate choice.

But three-speed spring motors are a rarity and the normal electrically-driven turntables would require far more power than could be supplied from batteries.

If, however, the turntable was to be used only for 45 rpm records its physical dimensions could be reduced and general efficiency greatly improved. Using a miniature motor with a permanent magnetic field the turntable could then be driven economically from dry batteries.

This technique was used in what is claimed to be the first commercially produced portable record player-receiver combination.

Braun, of Germany, now features a four-valve portable with built-in 45 rpm record player.

The set, a conventional receiver with ferrite aerial and bandpass filter, is contained in a plastic cabinet, which also houses the record player and provides storage room for six records in the lid. The cabinet is no bigger than the average portable receiver.

Besides the usual A and B batteries three baby torch cells are provided for the motor, which, incidentally, has a power consumption of only 80 milliwatts, less than the smallest torch bulb. A life of approximately 500 playings is claimed for these batteries.

AC operation, with a dry rectifier, is provided for at the touch of a button. The function switch consists of five buttons on the front of the receiver.

Special battery-saving features are built into the Braun Combi. Thus the turntable cannot be operated while the receiver is switched on. When the turntable is used the converter and IF filaments are extinguished, reducing the drain on both the A and B batteries.

X-ray image of a single-cylinder compressor as seen on the television screen. Note the piston and piston rod above and the crankcase below.

AN ALL-TRANSISTOR RECEIVER

First all-transistor receiver to go into full-scale commercial production is the American "Regency" personal portable, pictured on this page. Details of the set were published recently in the French magazine TSF et TV. We quote:—

THE set is well made and good performance is guaranteed by the outstanding response at high frequencies of the transistors used. The Texas Instruments Inc., of Dallas, the makers of the set, have been the first firm in the world to produce low-priced transistors giving consistent high gain at radio frequencies.

Four N-P-N transistors, connected in the grounded-emitter configuration are used. As IF amplifiers they give a gain of 36 db and, what is more important, 40 db as audio amplifiers. Such amplification has previously been attained in laboratories.

Looking over the circuit we find that there are only four transistors and one germanium diode.

The first stage, using a type T1223 transistor, constitutes the frequency changer, the signal being fed into the base, and local oscillation of the correct frequency obtained by collector-emitter feedback. A miniature two-gang capacitor serves as the tuning gang. Signal pickup is by ferrite aerial rod with a double winding, the second winding being the low impedance match to the transistor unit.

The IF stages consist of two type T1222 transistors. Two stages are necessary to obtain sufficient gain and also improved selectivity. Actually the low impedance reflected into the secondary from the transistor output and the primary somewhat impairs the gain of the transistor, hence it is necessary to use at least two stages of IF amplification.

The second detector is a germanium diode and the audio signal is fed from here to the output stage, utilising a T1210 transistor, via a 1000 ohm miniature potentiometer.

It is interesting to note the base connection of the second IF amplifier. This is taken directly to the emitter of the power output stage.

Sufficient power output is available to feed the Jensen diaphragm - type loudspeaker.

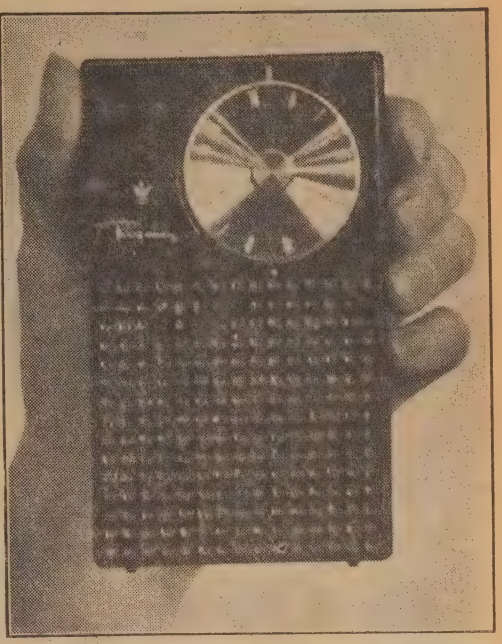
It would certainly be possible to substitute valves for transistors, to obtain higher power output than is possible with the present set. However, it is well known that even subminiature valves are very greedy as far as power consumption is concerned.

The need for adequate and economical battery size has for long been the limiting factor in the production of battery-operated receivers.

A 22½ V battery such as used in flashlights and hearing aids provides the operating power for the Regency receiver. It must be mentioned that although transistors will operate on voltages much lower than this, it is necessary to replace the battery if the voltage falls beyond a certain limit, in the interests of stability and performance.

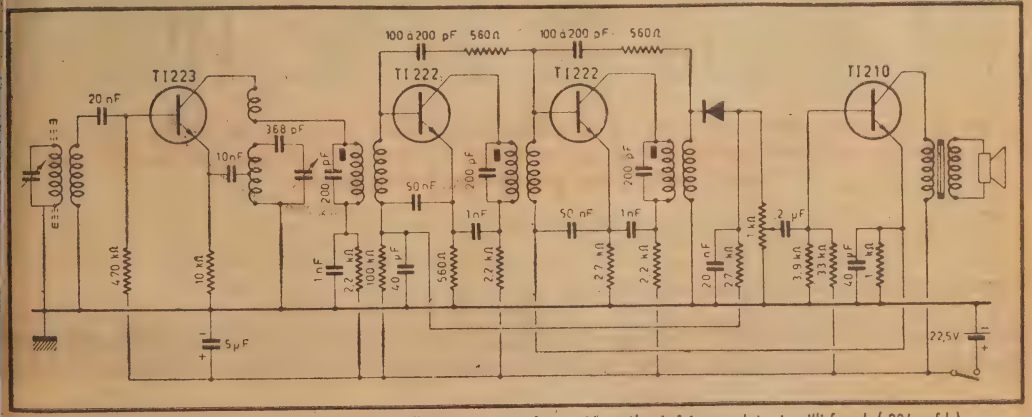
Another advantage of the transistors is that they are almost everlasting and replacement problems are not likely to arise. Only physical damage will allow the performance to deteriorate.

The present set is not a plaything of technicians or a laboratory curiosity, but a full-scale receiver which is designed to reinforce the position of present day manufacturing methods.



The complete receiver nestles easily in one hand. Comparable in size with two packets of cigarettes placed side by side, the cabinet measures 5 x 3 x 1¼ins. Weight is about ¾lb. The back slips off easily to allow the battery to be changed.

☆



Complete circuit details of the Regency all-transistor receiver. Note the 1nf is equal to 1 milli-farad (.001 mfd.).

Things are not always what they seem. Both the muscular he-man and the bathing belles in this picture are made of a few shillings worth of chemicals mixed with some gallons of water.

LIFE HANGS ON SMALL THINGS

by Calvin Walters

Among the many substances required to sustain life whether human, animal or vegetable there are minerals which are needed only in minute traces. Without them men would die, plants would wither, and growth would be impossible.

IT has been said that man is about 90 pc water. It has also been said that man is what he eats.

Both these statements have been made by eminent dietitians, but they seem a little contradictory.

Take the first. If this is true then the second cannot be, for how can a man be water if he doesn't drink it. According to the second statement some men should be 90 pc beer and ten pc water, the latter being what's in his beer.

If the second statement is true, the first cannot be, for if one is observant during the day, one will soon see that the average typiste should be cake or lolly, and the average man should be meat pie or tea or chewing gum, and the highly strung executive should be ulcer tablets or sodium bi-carbonate.

What of the average politicia He is often 100 pc air—but do let's complicate things any mo Highly intelligent people like tho who take the trouble to read wh I write are a little more highly o ganised. I include even the edit in these remarks, even though does get on my back occasionally f not putting in the commas, or pu ting them in the wrong place; ar I haven't put any in this paragrap so we will see what sort of a job makes of it himself unless he cu this paragraph out altogether make it easier.

As I said, we are a little mo highly organised, for our bodies co tain—aside from water, fat, protei and so on—many chemical element These are as follow:

Calcium, phosphorus, potassiu sulphur, chlorine, sodium, magn sium, iron, manganese, iodine, c balt, silicon, aluminium, arseni boron, copper, fluorine, nickel, zi

ESSENTIAL ELEMENTS

Some of these are very importa and essential to life while othe are more or less superfluous a are only there by accident.

The first ten, from calcium iodine inclusive, are found in a enter into the contents of the cel and fluids of the body. They exi in the body in comparatively larg amounts.

For instance, an adult man co tains about 2¼ pounds of calciu 1¾ pounds of phosphorus, half pound of potassium, five ounces o sulphur, three ounces of chlorine an sodium, down the list to a fractio of an ounce of iodine.

At this stage we will have t introduce a change of measuremen and work in grammes. In roun figures a gramme is about one thirty-second of an ounce. We wil also require to use the milligramme which is one-thousandth of

amme and the microgramme, hich is one-millionth of a gramme. A milligramme is, therefore, one ousandth of one-thirty-second of ounce and the microgramme is ne-milionth of one-thiry-second of ounce.

Both these weights are extremely nall and are given in this rough anner merely to give some idea readers when reading what is to llow.

The elements from cobalt to zinc clusive are found in the body only traces. In addition to these ere are elements which are need- in traces for the development plant life. These include vana- ium and molybdenum.

The trace elements as they are alled seem to act as catalysts in ne development of chemical reac- ons within the living matter.

In the blood, for instance, the iron tored in the liver cannot be con- erted into haemoglobin unless races of copper are present.

COPPER

The copper in the system exists as copper-protein compound and in he liver the copper content is about ive parts per million.

It has been estimated that the normal daily requirement of copper ntake for an adult is one to two milligrammes. Deficiency of copper n the diet can be responsible for anaemia.

Copper is derived from milk, but- ter, cheese, refined sugar, honey, margarine, lard and suet, in quanti- ties up to five parts per million. The most prolific sources are oysters with up to 400 parts per million. Lambs and calves' liver is also good, with up to 100 parts per million, yeast up to 100 parts per million, and cocoa- shell up to 200 ppm.

Copper is available in most fruits and vegetables, table salt, whole- meal flour and oatmeal and a host of other daily foods, so that there is little chance of at least some copper being unavailable for the average eater.

Zinc has a definite function in the human body, particularly in the transport of carbon dioxide by the blood. The average daily zinc re- quirement is about 8 milligrammes. It is also a necessary element for the formation of hard shells of hen eggs, a deficiency leading to soft shell eggs.

ZINC

Zinc is an important element in the production of insulin. Several investigators have found that the pancreas of a diabetic patient con- tains about half the zinc of a normal person. In the manufacture of insulin it has been found that the addition of minute traces of zinc prolongs the beneficial action of the insulin.

In agriculture zinc is an import- ant element of the soil where it is present in fertile soils in amounts of only about three p.p.m. (parts per million). A deficiency leads to various diseases such as mottle leaf disease, chlorosis and so on.

Zinc is available in most every- day food, particularly wheat germ, oysters, egg-yolk, peas, beans, coffee, rabbit, beef liver, rice, onions, &c. It is very widely distributed and there is little fear of a deficiency.

Cobalt has been proved essential to the growth of animals. From this it has been deduced that it is also essential to man, although to date there has been no proof of this.

Certain wasting diseases of cattle and sheep has been proved to be due to deficiency of cobalt in the pasture soils.

If the dry soil content of cobalt falls below five parts per million, wasting of the animals will occur.

The daily cobalt requirement of sheep is only about 0.1 milligramme. An extremely small amount. It has been calculated that on an average cobalt-deficient pasture, the addi- tion of only one ounce of cobalt salt to the acre would be sufficient to keep 1400 sheep healthy for a year.

MANGANESE

Manganese is essential to plant and animal life. In plants it seems to have something to do with the syn- thesis of chlorophyll. Lack of the element in the soil produces chlorosis in plants, withering of the tips of oats and other troubles. It seems to be essential to enable the plant to assimilate nitrates taken up from the soil.

The minimum requirements for most plants is a concentration of only 0.2 to 1 p.p.m.

In the human body the blood con- tains about 0.15 p.p.m. of manganese. The liver contains about 1.7 p.p.m.

Although as mentioned above the effect of manganese on human de- velopment is unknown, it is thought that it is essential to reproduction, for a deficiency of this element in animals leads to all kinds of faults in this function.

Most foods contain manganese in sufficient quantity for everyday needs.

The element iodine has received a great deal of attention because of its importance in the function of the thyroid gland.

IODINE

A deficiency of iodine leads to enlargement of this gland and in some cases to a stunted growth of the individual.

In natural products the occurrence of iodine is so small that it is measured in micrograms per kilogramme, or in parts per 1000- million instead of parts per million.

In the soil the iodine content varies from 800 to 8000 micro- grammes per kilogramme weight (1000 grammes). Fresh water con- tains very little iodine. The atmos- phere contains only about 1 micro- gramme per cubic metre but is some- what higher over the sea.

YOUR PHONE BILL BY CAMERA

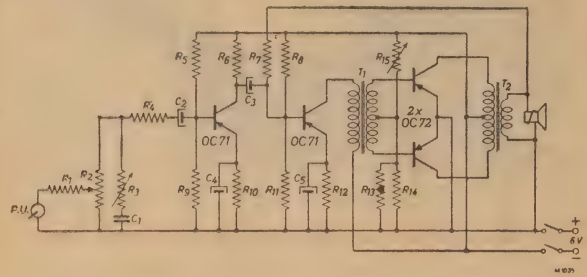
The new "Villette" telephone exchange uses a camera to photograph telephone sub- scribers meters in banks of 25. Mistakes are avoided and a record kept. The camera is fitted with mercury lamps with a fixed exposure of 1/50th second.

PHILIPS

Miniwatt transistors

announce **type 2-OC72**

for push-pull audio frequency applications



JUST RELEASED!

40-page "Miniwatt" semi-conductor booklet.

There is an excellent article on Semi-Conductors; it has application notes and full data on the "Miniwatt" range of transistors and germanium diodes.

Price 2/- (Post Free)

Applications—radio receivers, Intercom. systems, tape recorders and a host of other uses. Used singly the OC72 will give twice the power output of the OC70 or OC71.

Write for Data Sheet without obligation.

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Iodine is present in all plants, but nly in minute quantities or traces rom 2 microgrammes to 500. Seaveed contains much more—up to .2 pc.

The average daily requirement of odine for an adult has been estimat-d at about 45 one-millionths of a gramme. That is 45-millionths of one thirty second of an ounce—a very small quantity indeed.

The element boron is essential in small traces to plant life but there is at present no evidence to show that it is essential to animal life.

Several plant diseases are due to a deficiency of boron. It appears to have something to do with the reproductive function.

Three pounds of anhydrous borax per acre seems to be the maximum allowable in some cases. This represents the small amount of one quarter part per million in the top 12 inches of soil.

NITROGEN

Other plants like potatoes and other root crops will stand much more, so that when using borax it is probable that the area can be used only for those crops whose boron requirements fall within specified limits.

The element, molybdenum, has attracted widespread notice because of sensational results obtained in Australia and other parts of the world by the application of minute traces of this element to soils of very poor quality.

There are organisms in the soil which have a lot to do with the fixation of nitrogen in the soil. The most notable of these is called by the formidable name of Azotobacter chroococcum.

Soil must contain the correct amount of nitrogen, and this must be fixed in the soil. The above germ acts in helping to do this, but it has been found that it does this much better in the presence of molybdenum.

A concentration of molybdenum as low as one part in fifty-million increases the action of the bacillus one hundredfold.

One-tenth of a part per million stimulates the growth of lettuce. One-hundredth part per million is essential for the growth of tomato seedlings.

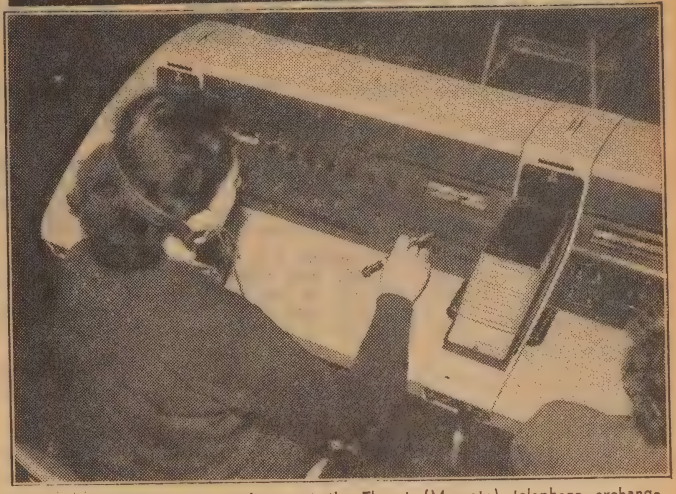
The sensational results in Australia mentioned earlier was in northern New South Wales, where ironstone soil of extremely poor quality was made to double the yield of lucerne by the addition of two pounds of sodium molybdenate to the acre.

A notable feature of all the elements necessary in traces for animal and vegetable nutrition and development, is the narrow margin which exists between the amount necessary for development and the amount which is toxic or poisonous.

BORON

For instance, boron, when added to the soil at the rate of one part per million, is just right for leafy vegetables. More than this will be toxic. A concentration of 1.6 parts per million is just right for root crops, but this will be toxic to grass and leafy vegetables. The difference is only .6 parts per million.

HELLO GIRLS PUSH BUTTONS



A new system is being tried out at the Thanet (Margate) telephone exchange, where operators sit at a board somewhat resembling the console of an organ. These are known as "cordless boards", because, instead of "plugging in" the operators use a "press button" system, which results in better marshalling of calls. No calls can be connected before one which came through earlier and callers "queue" for their turn. In the event of an emergency call coming through, this takes precedence over all others. The new system, dealing with the whole of Thanet, is by way of experiment to study the financial and efficiency side of the installation and to find out the reactions of public and telephone operators.

Iron has not been included in this discussion of trace elements for it is not truly so. It forms over 0.004 pc of the total body weight, so that the body of an adult contains about four grammes of iron. There is about 50 milligrammes of iron in each millilitre of human blood representing a concentration of 500 parts per million.

As stated above, copper is closely associated with iron in the human body, for it is the copper which makes the iron available in the liver.

Before we leave this discussion of trace elements, it is well to mention the vitamins, for they are indeed most necessary for nutrition yet are present in minute quantities in the food we eat, and are needed in very small quantities.

The administration of vitamins is based on the term, International Units.

This term originated when the League of Nations was in existence for this organisation took up the question, and a sub-committee arrived at the basis of measurement which was called the International Unit or IU for short.

It became necessary under this idea to standardise the activity of the vitamins. This is a little complicated to explain, but if I can make myself understood it will give some idea of the smallness of the vitamin unit required by the body.

Let us assume that it is necessary to standardise the activity of butter in preventing eye troubles. The vitamin in butter which does this is pro vitamin A or carotene.

In order to standardise butter it is necessary to do so against a sample of pure pro vitamin A. One International Unit of pure pro vitamin A is taken to weigh 0.6 microgrammes. This is six-tenths of one-millionth of a gramme (a gramme is about one-thirty-second of an ounce) so that this unit is infinitesimal.

Now if 10 grammes of the butter had the same pro vitamin A activity as six microgrammes of pure pro vitamin A, then the butter is said to contain 10 International Units of pro vitamin A.

The same procedure is adopted for all the vitamins. Nowadays vitamins are not known so much by vitamin A, B, B1, C and so on. They are known by their chemical names. For instance vitamin A is axeropthol. Vitamin B1 is thiamine. Vitamin B2 is riboflavin. Vitamin B2 complex is nicotinic acid. Vitamin C is ascorbic acid and so on.

VITAMIN A

The necessary intake of vitamin A for an adult is about 5000 International Units per day. This is 5000 times 0.6 of a microgramme, which is 3000 microgrammes or 3000 times one-millionth of a gramme, still a minute quantity.

It will thus be seen that for the food we eat and drink we take in very large quantities in order to gain the infinitesimal amounts of minerals and vitamins necessary for life.

Mullard '5-10'

HIGH QUALITY LOW COST AMPLIFIER

Creates phenomenal interest—the first consignment of handbooks sold out in three days!
(refer page 38 August "Radio & Hobbies")

Already widely acclaimed in Great Britain and America, the Mullard "5-10" has now captured the interest of the Australian amplifier and high quality reproduction enthusiasts. Additional stocks of the "5-10" Handbook (3/9 or 4/3 post paid) have arrived by air and a further quantity is due on the s.s. "Nuddea" this month. The unprecedented interest has even exhausted our stocks of one valve type but by the time this issue is printed two air consignments will have arrived from the U.K.

For the convenience of constructors, here is a list to date of "5-10" kit and special component suppliers. The components are also available from radio part suppliers and wholesalers throughout the Commonwealth. Should you have difficulty in obtaining any item, we will be glad to advise from our offices in Sydney and Melbourne and through our distributors, B. Martin Pty. Ltd., 35 Charlotte St., Brisbane, Q'land, Woollard & Crabbe Ltd., 18 Chesser St. Adelaide, S.A. and Sandovers Ltd., 691 Hay St., Perth, W.A.

KIT SETS

Electronic Products, Box 28, PO., Punchbowl, N.S.W.
Electronic Parts Pty. Ltd., 206 Broadway, Sydney, N.S.W.
Price's Radio, 5-6 Angel Place, Sydney, N.S.W.
Radio House Pty. Ltd., 296A Pitt Street, Sydney, N.S.W.
United Radio Distributors Pty. Ltd., 175 Phillip Street, Sydney, N.S.W.
Nova Electric & Engineering Company, 311 Sussex Street, Sydney, N.S.W.
Homecrafts Pty. Ltd., 100 Clarence Street, Sydney, N.S.W.
J. H. Magrath Pty. Ltd., 208 Little Lonsdale Street., Melbourne, Vic.
Homecrafts Pty. Ltd., 290 Lonsdale Street, Melbourne, Vic.
Radio Parts Pty. Ltd., 157 Elizabeth Street, Melbourne, Vic.

OUTPUT TRANSFORMERS AND POWER TRANSFORMERS

Electronic Products, Box 28, P.O., Punchbowl, N.S.W.
(output transformer only—Type 5571.)
Electronic Transformers Pty. Ltd., Gardere Avenue, Harbord, N.S.W.
(output transformer—Type A59.)
Nova Electric & Engineering Company, 311 Sussex Street, Sydney, N.S.W.
(output transformer—Type ML10.)
Ferguson Transformers Pty. Ltd., Ferguson Lane, Chatswood, N.S.W.
(output transformer—Type OP308.)
A. & R. Electronic Equipment Company Pty. Ltd., 378 St. Kilda Road, Melbourne, Vic. (output transformer—Type OT949.)

NOTES

1. Output transformer types mentioned here have been approved for the "5-10" by the Mullard Technical Service.
2. A special 300 volt 80 mA power transformer is required.

CHASSIS

Patton Products Pty. Ltd., 433 Princes Highway, Rockdale, N.S.W.
Arcadian Mfg. Company Pty. Ltd., 186 Rochford Street, Erskineville, N.S.W.

BASIC KITS FOR HORN TYPE SPEAKER ENCLOSURE

Price's Radio, 5-6 Angel Place, Sydney, NS.W.
Electronic Parts Pty. Ltd., 206 Broadway, Sydney, N.S.W.

COMPLETE "5-10" AMPLIFIERS

Aegis Mfg. Company. Pty. Ltd., 208 Little Lonsdale Street, Melbourne, Vic.
and leading parts suppliers throughout the Commonwealth.
Simon Gray, 28 Elizabeth Street, Melbourne, Vic.

Designed by valve applications engineers for quality performance at low cost, the Mullard "5-10" is rapidly becoming a standard with which other amplifiers are compared.

You must build and hear a "5-10"—and demonstrate it to your friends.

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Technical Review

MAGNETIC SOUND RECORDING ON SUB-STANDARD FILM

Magnetic heads and facilities are now available in this country for adding sound tracks to sub-standard movie films. An article in the French magazine, Revue du Son, gives a few hints which may be useful to readers contemplating the addition of magnetic sound-track facilities to an existing silent projector.

THE basic idea is an adaption of ordinary tape recording principles and comparable electrical circuits are required for recording and reproduction.

The film must first be submitted to the agents to be run through a special coating machine. This lays a narrow track of magnetic material along one edge of the film and outside the normal picture area. The position and dimensions of the coating vary with the size of film.

One or more magnetic heads have to be installed in the projector so that the film travels past them at even speed on its way into or away from the intermittent action.

To make the initial recording, the magnetic head is fed with a suitable audio signal and a high frequency bias, exactly as in a tape recorder. An erase head, installed immediately before it in the film run, can be used to eliminate any previous recording.

For playback, the head is switched across to the input circuit of the amplifier and signals previously recorded are reproduced in the loudspeaker.

LACK OF SPACE

One of the difficulties facing the amateur is the placement of more than one head in a suitable position on the projector. One method is to employ only a single dual-purpose head for recording and playback, erasing being done separately with a bulk eraser.

Mechanical considerations often do not leave much choice in the placement of even one head. In the interests of good speed regulation, both on recording and playback, the head should be located as far as possible from the intermittently moving part of the film and as close as possible to the speed regulating device. Three solutions appear to be practicable.

Converting a projector already equipped for optical sound track to magnetic sound track is the easiest of the three. Here the mechanism used to steady the film can well be utilised, by placing the head close to the position where the film runs over the flywheel shaft.

This method is often out of the question for amateurs, who only have silent projector. Because of space limitations such projectors cannot be readily modified to incorporate inbuilt mechanical smoothing.

Of two possibilities which remain, one is to place the projector on a pedestal which contains the necessary equipment to equalise the intermittent movement of the film. After the film has left the lower sprocket, it can be threaded through the system of pulleys in the smoothing equipment, before passing on to the take-up spool.

NEAR TOP SPOOL

In this case the record-playback head would be placed just before the film passes the flywheel.

The alternative position for the magnetic sound adaptor is between the feeder spool and the top feeder sprocket. This has the advantage of feeding the film into the mechanism at a constant speed, the continuous sprocket taking up any intermittent movement of the film and assuring, with the aid of a flywheel, a uniform rate of movement.

According to one authority, this method can be adapted to almost any silent projector.

Whatever be the method employed, the mounting of the head must be carried out with the greatest precision, the gap position being extremely critical.

The trace width is usually less than one millimetre and the part of the gap used is of similar dimensions. To obtain anything like a useful output, adequate precautions have to be taken to prevent lateral movement of the film, which would give rise to serious flutter effects.

In this, the procedure is very similar to the setting up of optical equipment, where the adjustment is very critical owing to the small dimensions of the sound track and the light slit.

AMATEUR, COMMERCIAL FILMS

All is well, while the showing of either amateur, or commercial films only is contemplated. Difficulties, however, are likely to arise, if the projector is required to handle both film types.

This is due to the fact that it is preferable to apply the magnetic striping directly to the film base and not to the emulsion side. Although it can be done, better adhesion is achieved on the film base, with the consequent extension of useful life of the magnetic coating.

Amateur films are generally taken on 16 mm reversal film, and they are projected with the emulsion toward the lens. This means that on most commercial machines fitted with speed regulating equipment for the optical sound track, the film would be travelling over the flywheel pulley with the emulsion on the outside. The base would be in direct contact with the pulley, making the placement of the magnetic heads

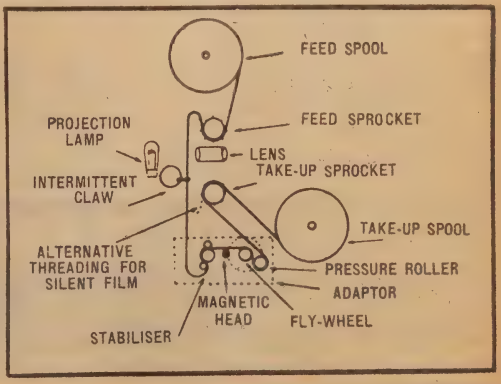


Figure 1: Illustrating how a magnetic head can be added to an optical sound projector, using the existing provision for speed regulation. The magnetic head rests against the film as it runs around the flywheel shaft.

There's NOTHING to equal

hi FERRIS fi

FERRIS HI-FI

HOME MUSIC SYSTEMS

Designed and manufactured by the makers of the famous FERRIS CAR RADIOS.

THIS EQUIPMENT *consists of five units—Power Suppl Power Amplifier, Equaliser-Preamplifier, Low Pass Filt and wide range tuner. Each unit is available seperatel and is self-contained except that the tuner, equaliser an power amplifier draw their required current from th separate power supply.*

TECHNICAL SUMMARY

Output frequency response of complete system from inpu to output 20 cps. —15,000 cps. + or — 1 db.

Harmonic and intermodulation distortion—Negligible.

Maximum rated power output—12 watts.

Hum and noise level — 60 db below full output.

Alternative input terminals are provided for magnetic o crystal pickups.

Degree of treble boost at 10KC/S relative to 1KC — 19 db.
Degree of treble cut at 10KC/S relative to 1KC — 19 db.
Degree of bass boost at 50 cps. relative to 1KC — 19 db.

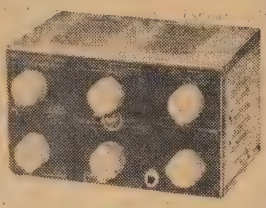
} Continuously variable.

HIGH FIDELITY RADIO TUNER

Has frequency coverage of 530 to 1,620 KC/S. Incorporates a 10KC/S whistle filter and special low distortion detector circuit. Large perspex dial calibrated for all Australian States and in metres and kilocycles.

EQUALISER-PRE-AMPLIFIER UNIT

Extremely wide flexibility of control is afforded over the entire musical spectrum, providing innumerable combinations of tonal balance. Six controls are utilised viz., a 5 position record equalising switch for all makes of records, a radio-records switch, a treble rise—treble fall switch, a volume control, a treble control, and a bass boost control (both continuously variable).



POWER AMPLIFIER UNIT. Incorporates highest quality output transformer with 17 db inverse feedback loop from secondary to amplifier input. Stable, low noise, straight forward amplifier with a completely flat frequency response from 15 to 15,000 cps. Negligible harmonic and intermodulation distortion.

POWER SUPPLY UNIT: Comprises a centralised power supply for the Ferris Hi-Fi Home Music System (or any other suitable equipment) and provided with sockets for plug-in cable attachment to the other units. A 6-volt A.C. outlet is also provided for external panel illumination, etc.

PRICES

RADIO TUNER, £30/14/-, EQUALISER-PRE-AMPLIFIER, £20/11/-, POWER AMPLIFIER, £29/2/6, LOW PASS FILTER UNIT, £12/8/6, POWER SUPPLY, £28/17/-.

LOW PASS FILTER UNIT

A "top cut" filter for eliminating inter-modulation distortion and/or surface hiss from worn or poor quality recordings when played either at home or broadcast on the radio programmes. Designed to provide a sharp cut-off characteristic at 2 cut-off frequencies, viz., 6 KC/S and 8 KC/S plus a third position in which the filter is switched out of circuit to utilise the full range linear frequency response characteristic of the amplifier.

FOR BEST RESULTS *high quality associated equipment is recommended for use with the Ferris Hi-Fi Home Music System . . .*

Suggested items are:—

Bakers 12in. triple cone loudspeakers	£25/16/3
Goodmans Axiom 150 Mark II loudspeakers	£22/16/-
Polished Corner vented enclosures for above	£33/12/-
Goodmans Axiette 101 8in loudspeakers	£12/17/3
Polished vented enclosures for above	£21/1/6
Thorens CBA83 automatic 3-speed record player with G.E. variable reluctance pick-up	£48/-/-
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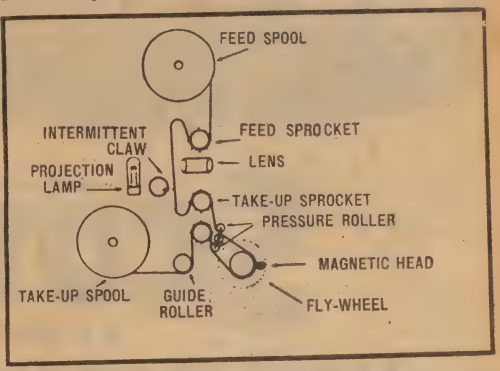
ther difficult, though not impos-
ble.
On the other hand, commercial
mm films are copies made from
master negative. These are pro-
ted with the base toward the lens.
ius, unless provisions are made
r an adjustment of the head posi-
n in relation to the film, it be-
mes quite impossible to use the
agnetic striping.
Similar difficulties can be expect-
in the case of prints made from
negative, or an original reversible
aster, for instance, when a mag-
tic sound track has to be made
one language, which already has
optical soundtrack in another.
These are the basic mechanical
roblems. Electrically, the results
n only be as good as the ampli-
r system, so that due attention
ust be paid to the basic prob-
ms of signal-to-noise ratio, ade-
iate frequency response and low
stortion.
Even allowing for good amplifying
uipment, results can be seriously
ompromised by other effects which
e not always appreciated by ama-
eurs. It is most important, for

The effect is due to the displacement of the operating point on the hysteresis curve of the head core material.

It is equally important to see that the reels carrying the film are not magnetised, or for that matter, parts of the projector close to or in the film path. The ideal solution is to use non-magnetic metal for reels and other relevant components.

This approach cannot always be

Figure 2: One possible method of adapting a silent projector for magnetic sound. The extra equipment is installed in a base unit, on which the projector rests. The film is threaded through the unit before passing to the final sprocket to take-up spool.



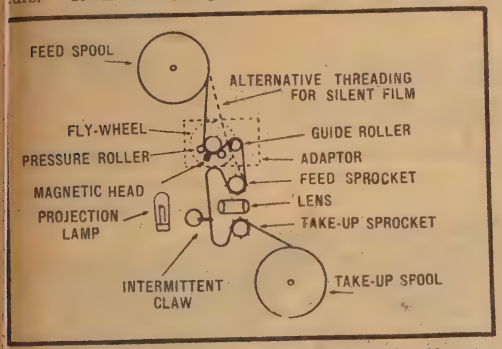


Figure 3 (Left): An alternative method of adding magnetic sound to a silent projector. In this case the head and flywheel mechanism are installed between the feed spool and the top sprocket.

xample, to avoid magnetising the
ead.
Such magnetism can occur, for in-
tance, if the recording head is sud-
lenly brought into, or removed from
he stray field of a loudspeaker. Also
ny discontinuity in the circuit, such
s when the head is connected, may
esult in a short, high intensity pulse
f DC and consequent magnetisation.
Unless the head is subsequently de-
magnetised, excessive noise level and
istortion may occur.
In particular, one must warn
gainst the practice of checking con-
inuity of the windings with an ordin-
ary DC ohmmeter.

BIAS SWITCHING

Another important point, not gen-
erally discussed in articles dealing
with magnetic recording, is that the
HF bias can cause residual mag-
netism of the head, if it is interrupt-
ed at the peak of the cycle. It is
particularly likely to happen when
the one head is used for both re-
cording and playback. It is there-
fore important not to cut the bias
current abruptly but to reduce it
gradually using, for example, the
discharge time of a bypass capacitor
on the bias oscillator HT supply.
This precaution, which is not
always observed by well-known
manufacturers, can give an improve-
ment in signal-to-noise ratio of 10
to 20 db, as against recordings taken
without these special precautions.
Distortion is reduced in similar
proportions.

applied if an existing equipment is to be adapted for magnetic sound. Too often the sprockets and rollers over which the magnetic coating of the film has to pass are made of ferrous materials. In such a case, the best one can do is to demagnetise these components as frequently as possible.

Having disposed of signal-to-noise ratio, attention can be directed to the frequency response of such recordings.

Although film speed does not affect the bass response of magnetic recordings to any extent, its effect on the treble response is marked.

The manufacturing technique of recording and playback heads has been so nearly perfected that, for practical applications, the frequency range of the head can now be considered unlimited. The real problem has to do with demagnetisation effects in the coating itself.

The magnetic coating on the film should naturally be suitable for the speed at which it is to be used. Oxides suitable for use with standard 35 mm film, the magnetic striping being 6.35 mm wide, at a speed of 77 cm/sec, would give deplorable results if used on 16 mm film with a speed of only 12 cm/sec.

RESPONSE LIMITS

This, of course, leads naturally into the question of what upper frequency response can be attained with present techniques, on the basis of 3db down on zero reference at 1000 cps?

We are not interested in the speed of 24 frames per second, as this speed is not used by amateur photographers. Movement can be depicted with sufficient accuracy at a speed of 16 frames per second and, with modern projectors, no trouble is experienced from flicker at this speed.

The use of 16 frames per second enables the amateur to cut film costs almost in halves.

The coating for the three types of sub-standard film is the same so that, assuming the same type of head and the same program material, the high frequency limit of the recorded sound varies in proportion with the film speed.

The upper limit of frequency response for 16 mm film at a speed of 12 cm/sec, and using magnetic coating and recording heads generally available in France, is well over 5000 c/s. Values for 16 mm and 9.5 mm are similar because there is only .8 pc difference between the two speeds. The frequency limit is halved for the 8 mm format, as the speed is only half of that of 16 mm film. Actually it is something over 3500 cps.

Results obtained with magnetic sound tracks thus compare more than favorably with those obtained by conventional photographic soundtracks, in the case of 16 and 9.5 mm film.

It is obvious, however, that the results are inferior to those obtained by synchronising a conventional tape with the film, using all facilities offered by modern tape recorders. However, it is likely that significant improvements will be effected in the future, particularly as far as background noise and frequency response are concerned.

BIAS COMPROMISE

With magnetic recording, a compromise has to be made in the bias level. High bias gives reduced signal level, with low distortion, but with an attendant decrease in signal-to-noise ratio. Lower bias gives high recording level and high signal-to noise ratio but higher distortion.

Under the most favorable conditions the magnetic recording process is capable of giving signal reproduction with a harmonic distortion of the order of 2 pc.

If we were to reduce the bias level in order to obtain good signal-to-noise ratio, the distortion may increase to about 5 pc. Provided the amplifier used does not introduce a prohibitive amount of distortion of its own, this figure would be acceptable in all except the most critical cases.

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ELECTRONIC READER FEEDS BUSINESS MACHINES

In a recent article in Electronics by D. H. Shepard and C. C. Heasly, jun., details are given of a photoelectric reader which is capable of transforming ordinary printed characters to business machine data at the rate of 3,600 words per minute.

WHILE "processing" machines for business data are by no means new, their use has largely been limted by the slow speed, high cost and low accuracy of keyboard operations.

This is so because the transfer of information from a business document to a machine record medium has always required the services of an operator to read the information and to manipulate a keyboard of some sort or another.

READS AUTOMATICALLY

The analysing reader eliminates this human limitation on the speed of electronic business machines by reading ordinary typed or printed characters and recording the information on machine mediums such as punched cards, perforated tape or magnetic tape. It is also possible to use information suitably sensed to control sorting, editing and table-lookup operations.

The operation of the reading system is shown in figure 1. A feed mechanism passes a single document in front of a photo-electric scanner which scans the characters on the document. Electrical pulses from the scanner are amplified and shaped by the video chassis and then analysed by the interpreter.

The interpreter identifies each character and sends identifying pulses to coding and storage. The storage serves as a buffer to meet the timing requirements of the output device. Information is withdrawn from storage and used to control the output device.

Storage also contains information as to whether or not the document has been successfully read. This decision is sometimes made by the interpreter, which can recognise errors caused by malformation of characters.

PROPERLY SORTED

If a document has been correctly read, it is placed in the accepted pocket; if not, it goes into the reject pocket.

A simplified diagram of the arrangement of the scanner is shown in figure 2. The document is fed at uniform rate past the reading station where it is brightly illuminated. The reflected image of the document is projected through a scanning disc on to a multiplier phototube through a series of lenses and a mirror.

The scanning disc, shown in figure 3, contains a number of radial slits which pass one at a time in front of a fixed slit. At the intersection of these slits, a point of light from the image passes through and is projected on to the phototube. As the disc rotates, the intersection of the slits moves to give horizontal scanning across the image.

Because the document is moving, the image is also in constant motion, so successive scans fall on successive portions of the image.

Since the scan rate is much faster than the document motion, 25 or 30 scans will occur as one character passes the reading station.

As the image of a character is scanned, the output of the phototube will vary. Thus, during a single scan the output will contain positive pulses representing dark portions of the character.

Figure 4 shows the typical pulse patterns produced by two capital letters. With the letter E, the horizontal lines produce three short pulse patterns for many scans. The long vertical line on the left produces one long pulse for at least one scan. Thus the input signals to the circuit would be a long vertical line on the left, three horizontal lines and nothing to the right of the horizontal lines.

Each letter gives its own particular character. If an impossible combination of strokes occurs, the interpreter recognises it as an error and sends out a reject signal.

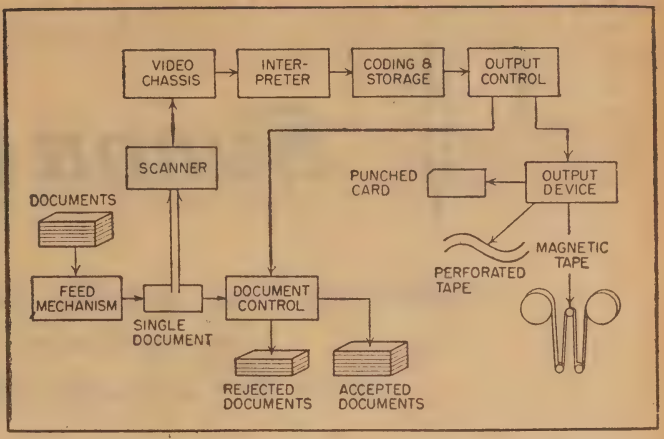

Figure 1. The complete electronic reading system for use with mechanical business machines. The model now under construction will handle over 450 documents per minute, reading printed data on each in turn and transferring it to the desired medium at speeds of over 300 digits per second.

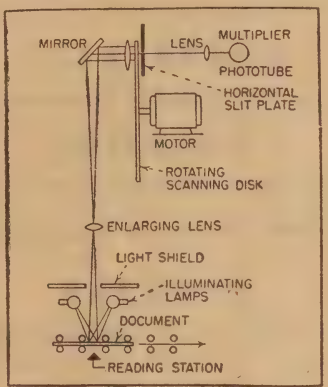

Figure 2. Optical system for scanning one line of text on document as it moves past reading station.

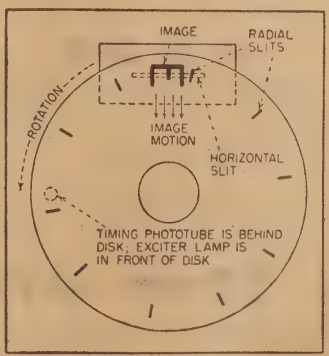

Fig 3. Details of the scanning disc used to obtain 25 to 30 vertical scans per character.

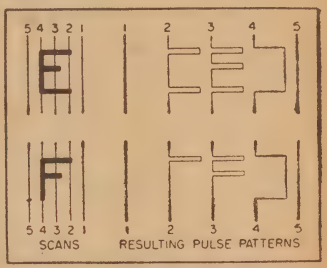

Figure 4. Characteristic pulse patterns resulting from scanning of capital letters E and F.

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MIC 36

Housed in attractive plastic case, this Microphone is ideal for home recording and public address, etc. Response unexcelled for its size and price. The performance is not affected by vibration, shock or low frequency wind noise. Omni- directional frequency response substantially flat from 30 to 7000 c.p.s. Recommended load resistance not less than 1 megohm dependent on low frequency response. Can be supplied complete with switch and floor stand adaptor as required at a small extra cost.

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SPECIFICATION

Recommended load resistance—not less than 1 megohm.
Output level —65 db ref. 1 volt/dyne/cm².
Frequency response—substantially flat from 30 c.p.s. to 10,000 c.p.s.
Directivity—non-directional.
Size—2-1/8in spherical diameter.
Connector—Standard international 3-pin.

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GENERAL PURPOSE

MIC 35

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The MIC 35, undoubtedly the best value ever offered, is ideal for amateur transmitters, public address, etc. Housed in an attractive die-cast case, it features a high sensitivity and substantially flat characteristics. Provided with a built-in shunt resistance of 2 megohms, it will, when connected to the grid of the input valve, give a substantially flat response from 50 to 5000 c.p.s.

SPECIFICATION

Output level: —55 db ref. 1 volt/dyne/cm².
Cable—approx. 4ft. of co-axial supplied.
Weight—6ozs. unpacked, 7 ozs. packed.
Dimensions—microphone only 2¼in x 2¼in x ¾in.

TABLE or STAND MICROPHONE

This omni-directional Microphone is robust in construction, with a pleasing appearance. Vibration, shock or low frequency wind noise will not affect the performance. The low frequency cut-off is dependent on the load resistance. The cut-off is given by the quotation, $F = 80$ divided by R, where F = c.p.s., R = megohms. An adaptor (floor mounting) is available at low extra cost.

MIC 22

SPECIFICATION

Output level = —50 db ref. 1 volt/dyne/cm².
Output impedance—equivalent to approximately 0.002 uF (0.8 megohm at 100 cycles).
Frequency response—substantially flat from 40 to 6000 c.p.s.
Recommended load resistance—not less than 1 megohm, dependent on low frequency response.

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LAPEL MICROPHONE

Designed to give freedom of movement, this Microphone is small and non-directional. Housed in a soft moulded rubber case, which gives protection against shock, it is provided with a pin at the rear of the case for pinning to the lapel.

MIC 28

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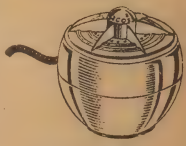
Output level—approx. —55 db ref. 1 volt/dyne/cm².
Recommended load resistance—5 megohms.
Frequency response—level throughout the whole of the audible spectrum.
Capacity—0.0015 uF. at 1000 c.p.s.
Impedance—100,000 ohms at 1000 c.p.s.
Cord—6ft. shielded cable.
Size—1-9/16in wide x 2¼in long x 5/8in thick.

HAND or DESK MICROPHONE

This Microphone has been designed for the high quality public address and home recording field. High sensitivity and flat characteristics are obtained by a specially designed acoustic filter. Housed in an attractive plastic case with an unexcelled response for its size and price. Unaffected by vibration, shock or low frequency wind noise. Omni-directional frequency response substantially flat from 30 to 7000 c.p.s.

MIC 33



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CRYSTAL MICROPHONE INSERTS

MICROPHONE INSERTS

(MIC 32 illustrated)

These inserts are available in varying sizes ranging from as small as 15/16in square to 1-13/16in round, with various thicknesses from 7/32in to 9/16in. Suitable for every purpose such as hearing aids, public address, tape recording, amateur broadcasting, etc., they have responses from 2250 c.p.s. to 3500 c.p.s. at 5 db to 30 db. Insert can be supplied with or without 10 meg. resistor as required.

MIC 19/4 and MIC 32, £2/15/6; all other, £1/19/6.

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NEWS AND VIEWS OF THE MONTH

Sun drives motor car

NOT long ago we read of experimental model radio sets operated by batteries which drew their power from the sun.

Although there is no present commercial value in such receivers they are of great value to engineers and scientists who believe that some day there will be an application for them.

Now we hear of a model motor car which is driven by sun power.

It will be on show in Chicago this month.

The 15in model, built by General Motors, has 12 photo-electric cells which convert light into electric current, which, in turn, drives a tiny electric motor to propel the car.

In the demonstration, light from electric lamps will be used to start the car.

Atom-powered subs

THE US Government is proceeding vigorously with its scheme to build atom-powered submarines.

In doing so, it recognises the value of the sub. in national defence and possible war, and the importance of providing a power source which will be light, compact, and capable of operating over long periods.

Whether all these targets have been met completely is known only to the US Navy.

But in recently letting a contract for the development of a nuclear reactor for a small sub, it is obvious that results are good enough for specialised designs to be considered.

By July the US will have nine atomic submarines with many others to follow.

America's present two atomic submarines, Nautilus and Sea Wolf, have engines already outmoded and the submarines are big and bulky.

The new US submarine will be conventional in size and therefore more manoeuvrable.

Designers of Nautilus and Sea Wolf did not pay much attention to the submarines' specific mission with the fleet.

Future atomic submarines will have to do a specific job.

Travelling in space

THE recent International Astronautical Conference in Denmark produced an unusually detailed and optimistic procession of forecasts about man's future preoccupation with outer space.

Almost every speaker at the conference, which included representatives from 16 nations, made light of the problems involved as being any barrier to ultimate success.

The general opinion seems to be that the first step is to create artificial satellites which will revolve around the earth and the moon, and, from their behavior, check our present knowledge of outer-space conditions.

These satellites are expected to provide new information which is necessary before man can confidently venture farther afield.

Dr. Wernher von Braun, the builder of the V-2 rocket, now a leading missile expert with the US Army, said that the United States plan to launch a satellite within three years marked the beginning of man's "last great adventure"—the conquest of space.

By 1985 commercial airliners would fly at altitudes of about 12 miles—nearly three times the present height, he said.

They would travel at speeds up to 2000 miles an hour.

Rocket ships would be operating, but not for commercial passengers.

"By 1985 we'll have a manned space station circling our globe in an orbit 1075 miles above the earth," he said.

"I think it is a good bet that within the next 30 years we'll see first an unmanned 'baby' space station—a small instrument-carrying rocket—fired into an orbit, say, 200 miles above the earth."

The president of the Aeronautical Association (Dr. Frederick Durant) predicted that man would set foot on the moon in 45 years.

"Within 25 years man will board satellites circling the moon," he said.

Dr. Durant said a space-craft travelling at 18,000 miles an hour—the speed the planned American satellite would girdle the earth—would take 13 hours to travel the 238,793 miles to the moon.

Professor Knut Lundmark, former head of the Astronomy Department of Lund University, South Sweden, said in Stockholm:

"The news about the first space satellites opens up gloomy perspectives."

If space stations were established they would give great strategic advantages to their owners, he said.

"There is a great risk of a struggle between different groups of powers for the first space station."

POPULAR SCIENCE QUIZ

Q.: What new drugs are being investigated for use in the treatment of rheumatoid arthritis patients?

A.: These are aldosterone, fluorohydrocortisone, metacortandralone and metacortandracin. Many patients using these new drugs have found increased relief from them and the results are superior to those obtained with cortisone and hydrocortisone. These new drugs also do not have some of the harmful side-effects of the other types. Such side-effects has often limited the use of drugs and, in many cases, the dosage has had to be reduced even at the expense of a return of some of the arthritis symtoms. Another limiting factor in the use of cortisone has been the difficulty of its production in quantity. Of the four new drugs, metacortandralone and metacortandracin appear to have the most beneficial results, although it will be a year or two before the true value of the new drugs can be assessed.

Q.: What is the earliest town discovered by mankind?

A.: A University of Chicago expedition headed by Dr. R. J. Braidwood, of the Oriental Institute, has recently discovered at M'lefaat in north-eastern Irak a town thought to be more than 7000 years old. It was at about this time in history that man changed from nomadic hunting to agriculture. Among the ruins were found excellent flint tools, axes, and heavy stone mortars. The absence of sickles in the ruins suggests that at that time they had not began to cultivate grain.

Q.: What is a twin-rotor convertiplane.

A.: This plane, designed and built by the Transcendental Aircraft Corp., USA, is similar in general appearance to a normal helicopter. However, instead of a single blade rotating in the horizontal plane above the fuselage of the aircraft, two smaller units are mounted on the wing tips. Once the aircraft is airborne these blades may be tilted forward to give forward movement to the aircraft in the same way as conventional propellers. Test flights of the aircraft have been made to a height of 3000 feet and the rotors have been tilted forward about 30 degrees.

Q.: How can radioactivity be used to measure machine tool wear.

A.: Machine tool bits are first subjected to radiation. Then the chips from the work being processed are collected. The amount of radioactivity transferred to the chips is a measure of the tool wear.

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The Palomar Observatory, California, has completed the first sections of a sky atlas, revealing stars, galaxies, and systems of galaxies stretching far out into space.

The observatory is sending out copies of the first 200 sections of the 1758-section atlas to observatories all over the world.

British A-plant plans

REPORTS say the British Army and Air Force are developing a number of mobile power stations working from atomic power.

They will be mounted in vehicles, which look like big tanks, and will be capable of travelling almost anywhere under their own power.

They would be valuable in providing electricity for landing fields or for troops stationed in areas where fuel was scarce.

These atom-powered "package power plants" are still on the secret list.

In general principles, the power plants will use steam turbines to drive electrical generators. The steam is provided by an atomic furnace, the whole thing being described as "a huge steam kettle".

Color TV unpopular

JUDGING from reports, color TV need not worry Australia for some time to come.

Manufacturers of TV sets in America have almost given up making sets for color.

They predict that sales of color receivers this year will be about 35,000.

This would be less than half of one pc of total sales.

Retailers estimate that total sales of sets this year will beat last year's record of 7,300,000.

The industry believes the present trend is for a second black-and-white set in the home rather than a color receiver.

Retailers estimate that 5 pc of TV owners have two sets.

They predict that booming sales this year will boost that figure to 7 pc.

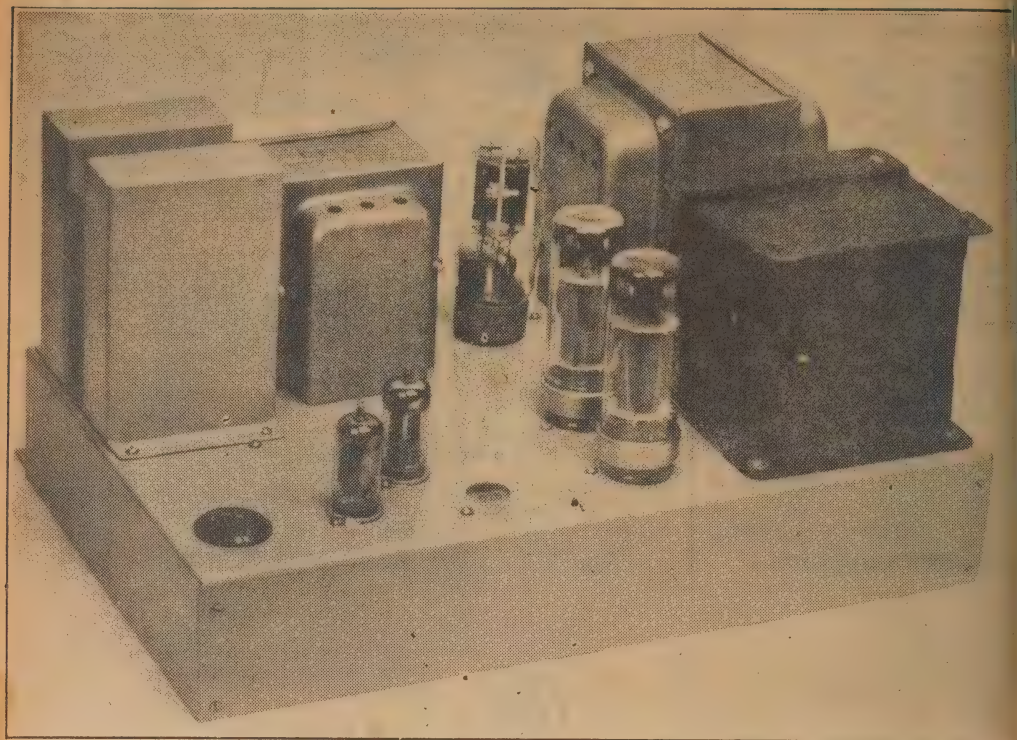
With no buying rush for color sets, the industry has no incentive to expand color television.

High-power tube

A NEW high-power radio tube called the "Vapotron" is currently being used in France. Cooled by the vaporisation of water, it is being applied to high frequency heating as well as to conventional radio and television transmitters. The tubes are so compact and powerful that they can replace several physically larger types and allow the size, cost and installation problems of the transmitter to be reduced quite significantly.

Maintenance and operating costs are also said to be reduced.

When the tubes are in use, the waste heat can be retained quite conveniently for auxiliary purposes such as heating the building. All this adds greatly to the overall efficiency of the installation, as demonstrated by the high power broadcasting transmitter at Strasbourg-Selestat, which is equipped with Thomas-Houston Vapotron tubes.



A front view of the amplifier. Plenty of room has been allowed on the chassis to accommodate any combination of components you are likely to use. Our blue-print will show the first two valves arranged in line. Note the paper filter capacitors, recommended because of the high voltage. Power and output transformers must have their cores at right angles.

A HIGH POWERED PLAYMASTER

Here is a really high-powered amplifier, nominally intended for a maximum output of 20 watts, but capable of up to 30 watts. It is intended for the largest high-fidelity installations, its high-power capabilities being designed to preserve extremely low distortion at useful levels. It operates with any of the Paymaster control units and tuners.

by John Moyle

HIGH-POWERED audio amplifiers have always had their following, and there seems to be every indication that they always will.

In the first place there are those who have a genuine use for 20 or 30 watts of output. There are the people who must operate multiple speaker systems, or who can only cover their requirements by brute force. They often include operators of small dance halls and picture theatres, as well as the small army of those interested in PA work.

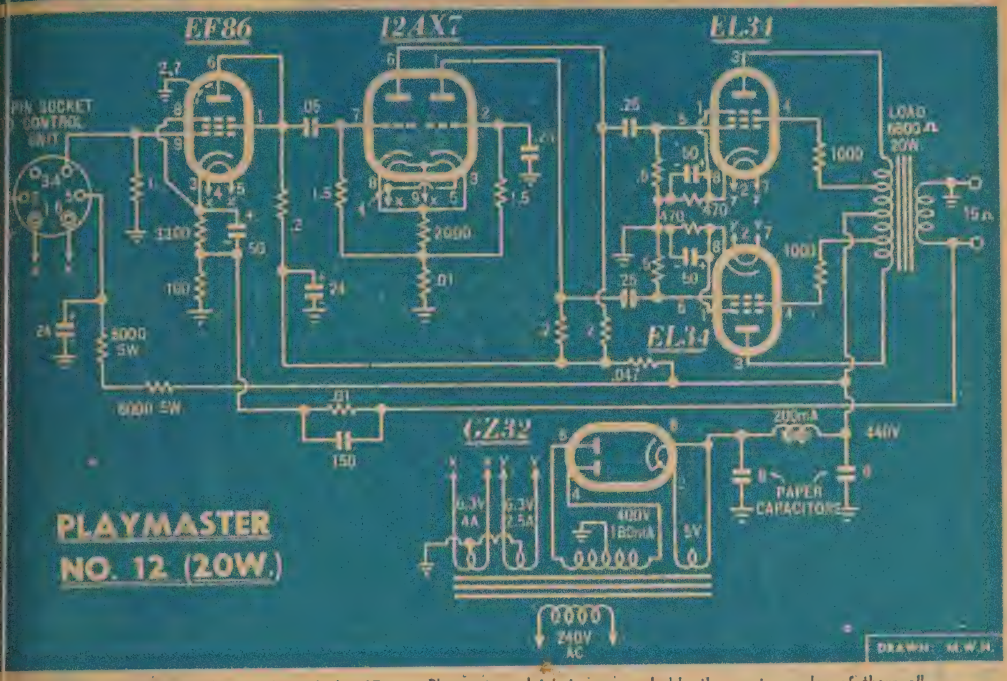
But there is also a school of thought which says we can't have too much power, even if we never use it. Better to have a 20 watt amplifier and load it lightly, than a 10 watt amplifier stretching out near the limit of its means.

The fact that a big amplifier costs a good deal more money to make isn't a deterrent to such people. They point out that a few more pounds might well have been spent on a fishing rod, or a cricket bat, or a photographic light meter, if other hobbies had attracted them. Why not then go for the very best if they are prepared to spend the money on their amplifiers?

There is ample evidence for this argument, for it is undeniable that amplifier distortion increases as the maximum output is approached, and will rapidly rise to an unacceptable figure just after this point.

We try to make amplifiers which retain an almost constant level of low distortion for as far along the power curve as possible so that the full capabilities can be usefully employed. But there is no doubt that the first 50 pc of available power has much less average distortion on

CIRCUIT DIAGRAM OF HIGH POWERED PLAYMASTER



The circuit is similar to that of the 17-watt Playmaster which is now probably the most popular of them all. Grid suppressors of 2000 ohms are often fitted to the EL34 valves.

comparative basis than the second pc.

It is therefore a good thing to use large an amplifier as is practicable th a working power point not eater than 1/10th to 1/20th of the aximum available output to pro- de ample margin for distortionless aks.

This estimate might seem an ex- avagant one, but we have more an once observed on an oscilloscope e ratio of peak-to-average output ltage from a well-cut LP record, d have been somewhat taken ack with its magnitude.

AFETY MARGIN

It would mean that, for a wide- nge system, a 10 watt amplifier ould not be operated at more than watts average power to maintain safety margain. In practice, this probably what happens in many ses, as this amount of power fed to a sensitive speaker system akes a very big noise.

For anyone who habitually uses igh audio power, therefore, a 20- att amplifier might not be an surdity nor an extravagance, par- cularly if he is one who believes in e value of high power purely on e grounds of lower distortion.

I am not at this stage making any rm recommendations to apply to articular cases. I would be the last suggest that you owners of 17- att Playmasters should immediate- throw them away and go all out r 30 watts, or even that the 10- att owners should raid their bank accounts for the good of the cause.

Rather am I recording that, if you have money to spend, and have a loud speaker system good enough to tell the difference, there is a case for a high powered amplifier, even if it is never pushed to its limit. I am acknowledging, too, that there are plenty of people who think that way, and who ask us how to make such amplifiers.

There are also readers who have in their possession the power supplies which once did duty in a Williamson, or who have in operation the original Playmaster No. 1, with its 807's and 425 volt power transformer, who are looking for something better. They may have no more than a hefty 385 volt transformer left over from the old days, with a choke to match, which looks very lonely doing nothing at the bottom of the junk cupboard.

But their minds are always turning toward a big job which someday they hope to build.

The recent release in Australia of the EL34 output valve, and the even more recently available data on its use in an Ultra-linear circuit, encouraged us to include in the Playmaster series a large amplifier which would supplant the early version, costing no more to make but giving much better results.

The EL34 is a big valve, and really comes into its own when producing 75 and even 100 watts of audio for special purposes. This it can do under very attractive operating conditions, as a glance through its operating data will show.

Naturally for these outputs very

PARTS LIST

1 chassis 14½ x 9½ x 2½in
1 power transformer 400v 180 ma, with 6.3v 4a, CT, 6.3v 2.5 ACT and 5v 3a heater windings.
1 12 Hy 200 ma choke.
1 Output transformer, 6600 ohm U/L, to suit speaker, 2 EL34 valves 1 12AX7 valve, 1 EF86 valve, 1 GZ32 valve.

CAPACITORS

2 8 mfd 400v oil filled paper (see text). 2 24 mfd 525v electros, 3 50 mfd 40v electros, 3 .25 mfd 400v paper, 1 .05 mfd paper 1 mica phase correction capacitor (see text).

RESISTORS

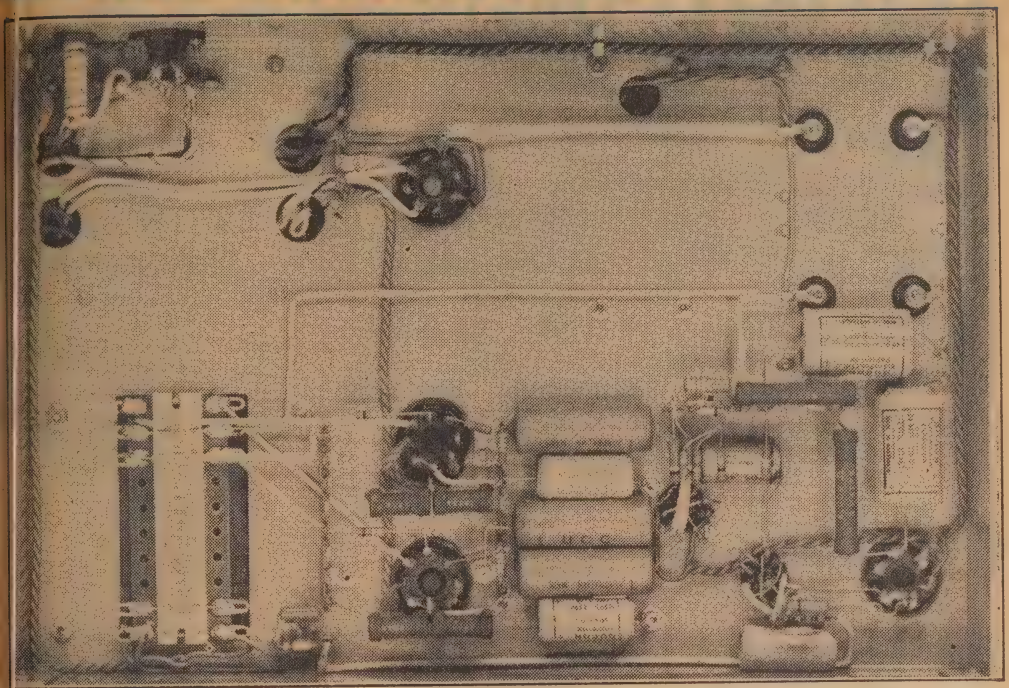
2 1.5 meg. 1 1. meg, 2 .47 meg, 3 .22 meg, 1 .01 meg, 1 3300 ohms, 3 2200 ohms, 2 1000 ohms, 1 100 ohms; feed back res. (see text.) all ½w. 1 .047 meg, 1W, 2 470 ohms, 3W, 1 2 6000 ohms, 5W.

3 Octal sockets, 1 6-pin socket, 2 Noval sockets.

SUNDRIES

Mains flex and plug, nuts, bolts, solder lugs, 4 8 lug strips (ST 28) 1 5 tag strip, (ST 25) 2 3-tag strips, hookup wire, tinned copper wire, spaghetti.

HIGH POWERED PLAYMASTER—UNDERCHASSIS VIEW



The underchassis view shows how the components are grouped to give a balanced type of construction. Plate cathode and feedback resistors connected to the EF86 should if possible be high-stability types to reduce noise. Phase-changer plate resistors should be 5 per cent types. Two resistors in series will probably be needed to get the right value for EL34 bias.

...h voltages are required, and by ... time we scale down operating ...ditions to the 10 and 15 watt ...el, we find the job can be done ...re efficiently by its smaller ...other, the EL84.

But for 20 or 30 watts, this valve ... too small. We could of course use ... EL37 with higher voltage, and ...ere is nothing wrong with this ...cellent valve, which we have ...eady used in the 17-watt Play-...aster No. 12.

...EW VALVES

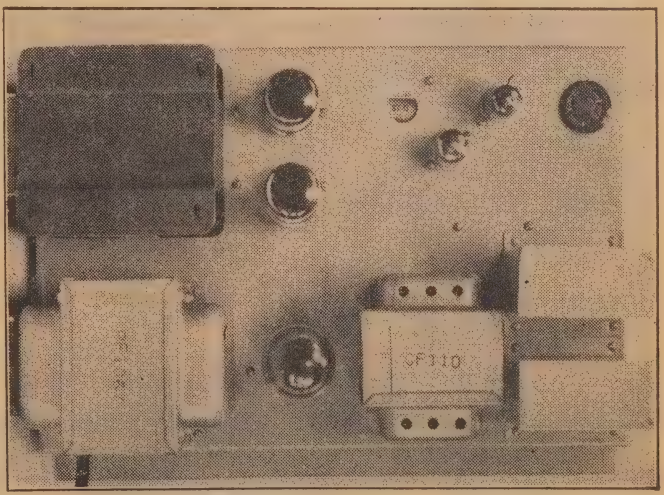
In this design we have used the ...L34 because it is a later type, and ... its merits must be taken into ...nsideration sooner or later.

Just as we were cogitating on its ...plication for ultra-linear work, an ...plifier circuit was released by ... Mullard company using ultra-...ear EL34's, which was, in effect, ... vehicle for publishing authorised ...ings for this type of service. Its ...ecifications reveal that the valve ...rks very well in ultra-linear con-...ction, and with an effective power ...pply of 400 volts will deliver near-... 35 watts of output power.

The amplifier is rated as a 20-watt ..., so here again we have this idea ... providing a high output maxi-...m, and using only portion of it ... restrict distortion.

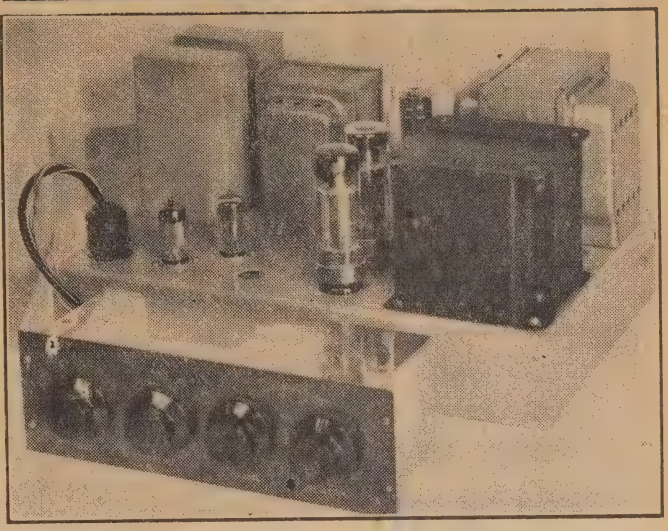
The circuit uses the same direct-...upled front end as was featured in the amplifier described in last month's issue, but is otherwise substantially the same as the 17-watt Playmaster circuit described earlier in the year. Its distortion figures at the 20 watt level, feeding a resistive load, are extremely low.

Although at the time of writing we



This top view illustrates the general amplifier layout. The final design will line up the EF86 with the 12AX7. The odd socket hole was made during some experiments.

AMPLIFIER WITH CONTROL UNIT



Here is the amplifier with the control unit No. 4. The two are connected by a cable and may be separated by several feet.

e not measured the distortion he amplifier described here, we e available some measurements e on a similar amplifier. It was t with the same output trans- er as shown in the photographs, with 325 volts high tension.

s a matter of interest, the figures v a total distortion at 20 watts pproximately .1 pc at 1 Kc, and intermodulation distortion of er .5 pc taken at 40 cycles and c in the ratio of 4-1. Feedback 20 db and similarly applied.

ith our power supply giving 400 s between plate and cathode, re- s should be even better.

will readily be seen that to t hairs over figures of this order nere waste of time, particularly our average operating level will ly exceed about two watts even really high volume.

GH MAXIMUM

he extra voltage we used allowed to measure 33 watts output at 1 31.5 watts at 50 cycles and 28 ts at 15 Kc, which, for a trans- ner rated at 20 watts, isn't a bad formance. Naturally distortion res at this high level may not quite as low, but it is an indica- of overall performance.

he frequency response we obtain- using 22db of feedback, and with amplifier adjusted to give the t square wave response, is shown a graph with this article. From aboratory standpoint it isn't as ressive as some amplifiers we e built, which show little varia- up to almost 300 Kc. But from ractical standpoint, any amplifier ich is only 1 db down at 60 Kc, which exhibits such a docile at- uation after that is not only in a h class, but more than compares h any commercial type you can .

t the moment this appears to be only 20-watt transformer avail- e, but there are several 15-watt es, some of which we have tested h almost identical results, except maximum power output figures. the time this article appears in nt there will probably be several es available from the well-known nsformer factories.

he circuit is virtually the same that used for the 17-watt Play- ster for the good reason that we v no occasion to change it.

ENERAL CIRCUIT

It consists of a triode amplifier, istance-capacity coupled to a hode - coupled phase - changer, ich is coupled by a similar method the output stage.

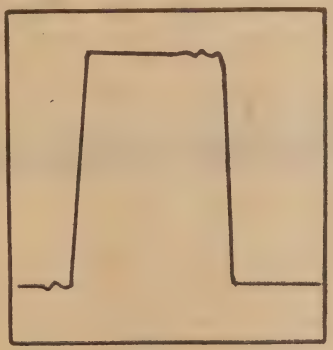
The first valve is an EF86, which not only non-microphonic, but has low noise level. The phase- anger is a 12AX7, which gives ap- ciable gain in this position.

The over-all feedback works out approximately 22 db. This is a tle higher than we advise for neral use, but output transformers itable for this amplifier are not dinary types, and this one in par- ular has been designed to operate th this degree of feedback with- t running into instability.

It will actually stand even more edback than this, but when tuners d control units are added, with eir capacity for extra bass boost, ere is always a risk of motor-boat- ing without extreme precautions and circuit complications with very little to be gained.

It is possible that, with the gain wide open, full bass boost, and the selector in a position which has no bass roll-off (the 78 position, for instance), there might be a tendency to motorboat in some cases. It is most unlikely to do so in either the Decca or EMI positions.

But no one in his senses would expect to operate the amplifier under



An oscillograph tracing of a square wave of 5 Kc fed into the input of the amplifier. It shows very little ringing or overshoot, and is appreciably better than that of most commercial amplifiers.

these conditions, which will allow the full 30 odd watts to be obtained with an input of 20 millivolts or less.

In fact, one of the precautions one must expect with a big amplifier like this is to operate the gain control with a judicious hand. If your motor car will reach 100 mph, you don't put your foot down without giving the matter some thought!

The sensitivity of the amplifier for full output is just under .3 volts, which is within the design limits we expect of the Playmasters.

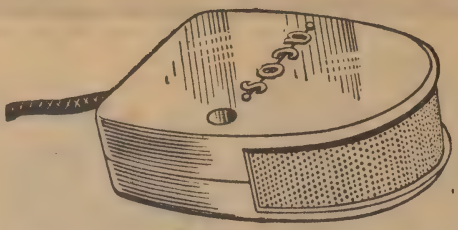
Despite this high sensitivity, the hum and noise level is no higher than with any of the others, remembering the extra available output. You don't build an amplifier like this in order to listen to it from a distance of six feet, but you would have to get closer than this, in all probability, before being conscious that the power was turned on. The total amount of noise is a little higher than with the lower powered jobs, but it is still low enough to be limited by the performance of the valves and perhaps the resistors used in the first stage.

RESISTOR NOISE

For this reason, it is a good idea, as it is with all the Playmasters for that matter, to use high-stability resistors in the EF86 plate and cathode circuits, as well as in the feed-back circuit. These can now be obtained, and we suggest you obtain them if you are very fussy.

Elsewhere in the circuit the gain is low enough for this precaution to be unnecessary.

With the high-mu phase-changer, balancing the plate resistors for perfect amplifier balance isn't as important as with lower-mu valves, and with 5 pc resistors, the slight unbalance will only be observed on a full output test, where one sine-wave peak will flatten off a fraction before the other. It is hardly worth bothering about unless you are able to balance the amplifier with an oscillator and an oscilloscope, particularly as the design deliberately avoids using full output.



A NEW SENSATIONAL CRYSTAL MICROPHONE!

ACOS MIC 35 (HAND AND/OR DESK TYPE)

AT THE AMAZING PRICE OF

£2/15/0

A general purpose microphone with high sensitivity and substantially flat characteristic. Housed in attractive Die Cast Case of very robust construction is particularly suitable for use in recording apparatus — Public Address Equipment — Dance Bands — and similar applications.

Provided with built-in shunt resistance of 2 megohm giving response substantially flat from 50/5,000 cps. Resistance of the input circuit will reduce the low frequency response. A grid leak of ½ megohm will reduce the output at 500 cps by 3 dbs and pro rata at lower frequencies.

Approximate capacitance of the microphone is 750pF and cable capacitance will reduce output proportionately.

Frequency response	Substantially flat from 50/5,000 cps.
Output level	⇐ 55 db ref. 1 volt/dyne/cm2.
Load resistance	2 megohms included.
Cable	This microphone is supplied with approximately 4ft. 1.2 metres of co-axial cable (type Unirad 32).
Weight	Microphone only — 6oz. (approx. 170 grammes) complete with packing 7oz. (approx. 198 grammes).
Dimensions	Microphone only 2 7/8in x 2 1/8in x 7/8in plus cable. Complete with packing 3 3/8in x 2⅜in x 2⅛in.

Sole Australian Agents:— **AMPLION (A'sia) PTY. LTD.** 88 Parramatta Rd., Camperdown, Sydney, N.S.W.

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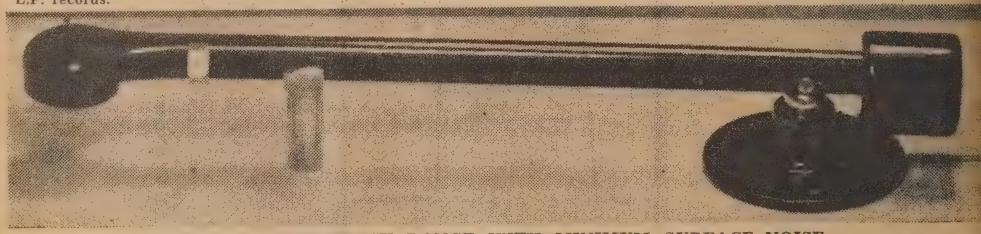
TYPE C WITH IMPROVEMENTS

The ACME of Perfection in High Fidelity Sound

WIDEST FREQUENCY RANGE—LOWEST DISTORTION

The performance of the M.B.H. is second to none in the world; its addition will improve your amplifier, whilst with the circuits specially designed for it, the first impact on the listener is frequently amazement at the quality of the better L.P. records.



EXTENDED FREQUENCY RANGE WITH MINIMUM SURFACE NOISE

Because surface noise is composed of all frequencies, the surface noise reproduced by a pick-up is proportional to the area below its response curve. It follows that peaks in the response curve increase the area below the curve and so the noise reproduced is greater. A peak in the response curve also makes the surface noise far more noticeable still, by unpleasantly colouring it with the frequency of the peak.

The M.B.H. Pick-up is the only one on the market whose high frequency resonance is above 20 Kc/s. Thus with an M.B.H., wide frequency range can be enjoyed with a minimum of surface noise. Both private and professional customers have often stated that many discs which had previously been put aside as no longer playable, come back into service when a change was made to an M.B.H. Pick-up.

M.B.H. PICK-UPS AND ACCESSORIES

	£	s	d
16in with one sapphire head	16	18	7
16in with one diamond head	26	0	3
14in with one sapphire head	15	2	6
14in with one diamond head	24	4	2
12in with one sapphire head	13	19	0
12in with one diamond head	23	0	8
Extra heads with sapphire	8	3	9
Extra heads with diamond	17	5	5
Tubes of 5 sapphire styli	1	15	0
Diamond Styli, each	9	8	8
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M.B.H. PRE-AMPLIFIERS.

Type (A) with power supply	57	8	6
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M.B.H. 30 watt output-transformerless amplifiers	136	16	0

TRADE ENQUIRIES INVITED.

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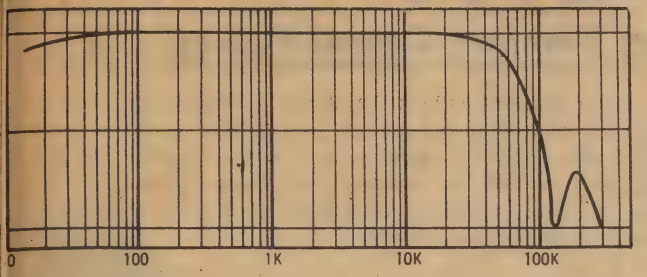
GRAPH OF FREQUENCY RESPONSE



is graph shows the frequency responses of the amplifier with the transformer ustrated by the photographs. Distortion figures at operating levels are negligible ie amplifier is only 1 db down at 60 Kc. The slight fall at the low end is largely ue to the bypass condensers on the output valves, but is in any case insignificant.

he output stage is operated under conditions advised by Mullard the EL34's. You will notice suppressors are used in both en and grid circuits. The lat- is always a good idea with high- valves, but the valve makers t out that linearity is improved using the screen resistors in ad- on to their value as a stability caution, despite a slightly lowered put.

'ARATE BIAS

eparate bias resistors are also d for these valves, not so much the interests of low distortion as allow each valve to adjust its n bias if initial matching is not fect, or if characteristics should y with age, as they are almost tain to do.

The load requirement for the ves as pentodes is about 3-4000 ns, and with high feedback and ultra-linear connection the exact d within reason isn't important. wever, the optimum figure is given 6600 ohms, and there are several and 20 watt transformers of suit- e type available in this ue. As previously mention- there will probably be re of them soon, specially de- ned for this valve. There is, refore, every reason to use them.

The power supply must provide a al high tension voltage of about 0 volts from the filter, allowing 32 lts of bias for the output valves d approximately 400 volts effective tween plates and cathodes.

To do this we have used a trans- mer wound for 400 volts per side 180 mills which, when used with e GZ32 rectifier, gives almost pre- ely the required volts.

)WER RATINGS

This transformer has already been ade by one manufacturer and will obably be obtainable in several ands before long.

There is a type of transformer rated 425 volts per side at 175 mills, iginally designed for the William- n circuit. This transformer is suit- le, although you may have to paral- the filament windings to obtain fficient load distribution. This, ain, will depend on whether the plifier is used with a tuner or t.

In this case, it is advisable to e a pair of dropping resistors in each high tension lead to the rectifier to reduce the applied voltage to 400, or to whatever voltage gives 440 volts from the filter. This should be considered the maximum permissible voltage, particularly with respect to condenser ratings throughout the equipment.

On this basis it is practicable to use the power supply from the Playmaster No. 1, in which this type of transformer was used.

Because of the high output voltage of 440 volts, it is too risky to use electrolytic condensers directly after the rectifier valve. A breakdown here would almost certainly take the rectifier with it and might do other damage as well.

Fortunately, there are a number of paper condensers available through disposals sources for less than 10 shillings each which can be used in this amplifier.

The pair we used were rated at 8 mfds, 400-volt working, and there is another type rated at 4mfds, 600-volt working.

These disposals type condensers were almost invariably rated at a temperature of 140F, with a lower rating sometimes given at 160F. It is highly likely that a rating of 500 volts working at 70 or 80F would be quite normal for the 400-volt types, and there seems little reason

d consider them a risk with this
a plifier.
The 4 mfds types would probably
s ply adequate filtering, and 8 mfds
s uld be considered the maximum
v ue to be used directly after the
r tifier.
It should be quite satisfactory to
u a 600-volt peak electrolytic con-
c iser in place of the paper type
c nected after the filter choke,
v ere there is virtually 440 volts DC
t be handled.
As a general rule, these electro-
l ics are suitable for DC operation
u to 500 volts, so that there would
b a reasonable safety margin.
A capacitance of 16 mfds would be
a ple.
There appears to be no direct sub-
s ute for the GZ32 type rectifier.
This is a type rather similar to
t 5V4G, but the makers have been
r re generous with their ratings.

CTIFIERS

The 5V4G would be over-run in
t power supply on this basis, al-
though the GZ32 is often supplied
i place of the 5V4G for replace-
ment.
Directly-heated rectifiers such as
t 5U4G can be used in this am-
plifier, but the output voltage will
be less. The difference is only about
l volts or so, but, being a directly-
heated valve, the supply voltage will
r e to something like 550 volts un-
t the remaining valves have heated
u and begin to draw plate current.
This means that all the conden-
s s in the HT circuit in the am-
plifier, control unit and receiver are
likely to receive this voltage during
the warm-up period, and must there-
fore be not less than 600 volts work-
ing.
The GZ32, on the other hand, has
a slow warm-up time of 25 seconds,
and this is designed to be a longer
period than any of the other valves.
Consequently, by the time the rec-
tifier comes into operation the am-
plifier is already warmed-up, and
the high tension voltage at no time
exceeds its operating value.
The makers do not require the
use of resistors in the transformer
secondary leads to the rectifier except
as a means of controlling voltage.
The amplifier has been built on
a new chassis, as none of the exist-
ing Playmasters will accommodate
the rather large components with
enough margin to accommodate pos-
sible differences in size between dif-
ferent makes.

AIN FILTERS

The main filter condensers have
been placed away from sources of
heat, and there is enough room on
this part of the chassis to mount any
type you are likely to use.
The power and output transform-
ers are mounted quite close to each
other, but their cores are exactly at
right angles to their centres. In
this position there is virtually no
inter-action between them, and neg-
ligible hum fed through to the out-
put.
They are, however, spaced as far
apart as the chassis will allow. No
cut-outs have been specified on the
chassis blueprints, as these would not
be suitable for all the components
which might be used. They should
be mounted with whichever orienta-
tion is most convenient.
The positions of the filter choke
and rectifier are clearly visible. The

(Continued on Page 57)

WORKING WITH HIGH FREQUENCIES?

then you'll need these 2 Resistors

IRC AUSTRALIA

TYPE **MP**
MEDIUM & HIGH POWER

TYPE **MPM**
MINIATURE LOW POWER

HIGH FREQUENCY RESISTORS

TYPE MPM
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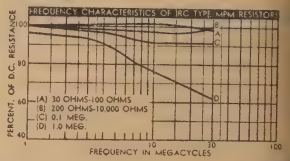
IRC Type MPM Resistors are miniature units suitable for high frequency receiver and similar applications. Resistor body is $\frac{7}{16}$" by 0.100" (over cups), and the active resistance section is $\frac{3}{8}$" long.

RESISTANCE VALUES: 30 ohms to 1.0 megohms. **TOLERANCE:** Standard ±20%. Special ±10%. 5% not available. **POWER RATING:** ¼ watt, at 40°C. ambient temperature. **MAXIMUM VOLTAGE RATING:** 200 volts peak. **CAPACITY BETWEEN TERMINALS:** 0.015 Micro-microfarads. **TEMPERATURE COEFFICIENT OF RESISTANCE:** Approx. —0.04% per degree over temperature range of —55°C. to +80°C.



The range MPF to MPR Medium and High Power High Frequency Resistors, rated between 2 and 90 watts, are designed for frequencies above those of conventional resistors. They are suitable for such applications as broad band RF amplifiers, RF probes, rhombic antenna terminating resistors, dummy loads for transmitters and dielectric heating equipment, television side-band filters, surge generator and other circuits involving steep wave fronts, high frequency measuring circuits and radar pulse equipment.

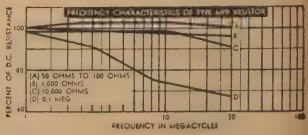
RATINGS indicated are maximum based on free air operation at 20°C. ambient. **DERATING** curve is available on application. **TEMPERATURE COEFFICIENT:** —.005%°C. for low values, —.07%°C. for high values. **HUMIDITY:** Several protective coatings of special varnish, each baked at high temperature, provide protection against effects of abnormal humidity.

TYPE	Power Rating	Peak Voltage Rating	Minimum Available Resistance at 20% Tolerance	Maximum Available Resistance at 20% Tolerance	Dimensions	
					Ceramic Length	Resistor Body Diameter
MPF	2 watts	500	20 ohms	1.5 megohms	1-3/4"	5/16"
MPG	4 watts	500	20 ohms	1.5 megohms	2"	9/16"
MPJ	5 watts	1000	35 ohms	3.0 megohms	3"	9/16"
MPP	10 watts	1750	25 ohms	2.5 megohms	4-1/2"	3/4"
MPA	20 watts	2750	35 ohms	4.0 megohms	6-1/2"	1-1/8"
MPO	30 watts	4750	50 ohms	5.0 megohms	10-1/2"	1-1/8"
MPR	90 watts	8500	60 ohms	6.0 megohms	18-1/2"	2"

Available with Lug Terminals and range of Ferrules.

TYPE MP
MEDIUM & HIGH POWER

Contact your usual supplier for full details.



YOU WANT TO BUILD AN ORGAN?

Continuing his discussion of home-built electronic organs, the author this month passes on to an examination of tone-generating circuits using neon and vacuum tubes. Some typical commercial arrangements are reviewed with the possibility in mind of adapting them for home construction.

PART TWO

by R. A. B. Tarrant

The use of neon tubes as gener-ors and dividers has received a od share of attention over the ars and patents on their applica-n are being registered continu-y, and in relatively large numbers, ing back to the past 30 years, or re.

For commercial purposes the gase-s tube — whether it be neon lamp thyratron — is not satisfactory: ere is too much variation and tability from tube to tube to ike their commercial use a good position, and only one firm (an glish one) makes any use of these es, and in this case to a limited tent, only.

However, for the home constructor me most satisfactory organs can developed around this class of nerator, and very pleasing results tained. One such satisfactory in-ument is Dorf's patented Electron gan.

EQUENCY DIVISION

A large proportion of commercial struments, utilising vacuum tube nerators, resort to frequency divis-n as a means of saving on valves. owever, a saw tooth wave is, more ten than not, required at the output each divider, and this calls for ned circuits and special treatment nen using vacuum tubes.

If neon tubes are used, sawtooth ave forms are readily obtainable, thout involved circuitry. Further-ore, division of the frequency fed the divider may, at the same time, had, whether it be by two, three, ur or some other integer. This fact of considerable advantage, and n well be borne in mind when de-ding upon what sort of a basis an perimental organ will be built.

The reader is asked to note that is is a general article about the bject of building electronic organs, nd it is not proposed to give detailed circuits. Such information may be had from Douglas' well known "Electronic Musical Instrument Manual", which also has a fairly good reference list, and forms a satisfactory foundation for the advanced study of this subject, more practical developments being given in his latest book "Simple Electronic Musical Instruments for the Constructor".

Also, providing contact is made through the editor of "Radio, Television and Hobbies", the writer is prepared to advise anyone interested enough to write, on the availability of specific data. In addition, certain firms advertising in this magazine are known to be approachable on the subject, and can probably give a fair amount of information on the availability of circuitry, data and components.

These main two advantages of the gas tube its ability to divide easily, and at the same time to provide a sawtooth output, weigh heavily in its favor for consideration by the home builder.

We now turn to a well-explored field, from which has sprung a bewildering array of devices—oscillators and dividers in all stages of simplicity and complexity — and we find ourselves wondering just where to start.

Since this article is addressed to people who are interested in building an instrument, it may be as well to glance over the various major commercial makes of electronic organs.

In the USA the most publicised are the Allen, Baldwin, Connsonata, Lowery and Minshall organs and in Great Britain the Constant Martin, Jennings, Lincoln and Maestrovox.

ONE TUBE PER NOTE

Of these Allen, Constant Martin, and Connsonata use individual tubes per note of the instrument, the remaining makers resorting to frequency division in one way or another. It is interesting to note that the organs having one tube per note all use inductances for determining the various frequencies. Inductances represent a lot of work (or a lot of money) to have wound, and for this reason do not appeal to the amateur, although construction of such instruments is well within the capabilities of the hobbyist, and give, in general, a better return for the financial outlay involved.

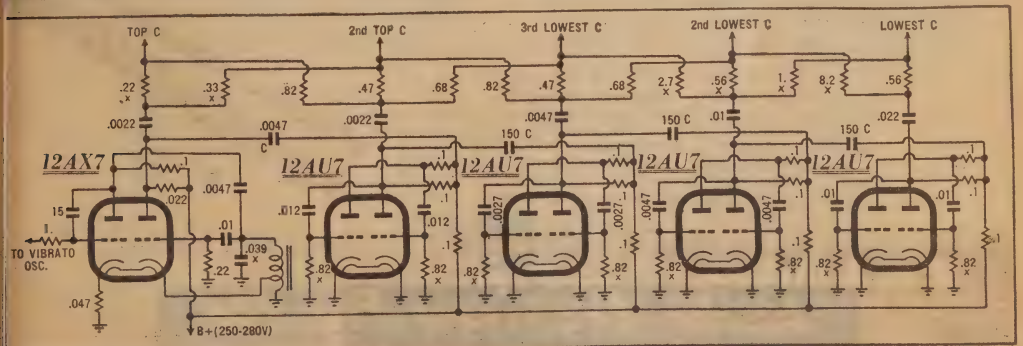
Of the others, the Baldwin, Lowery and Minshall instruments represent a fair average representation of frequency division in practice.

In the writer's opinion the Baldwin organ is the pick of the lot, being truly organesque in attack and tone.

It, however, presents two major obstacles to the would-be constructor: one of these is the method of keying which will be explained later, the other is the generator divider system which is demonstrated schematically.

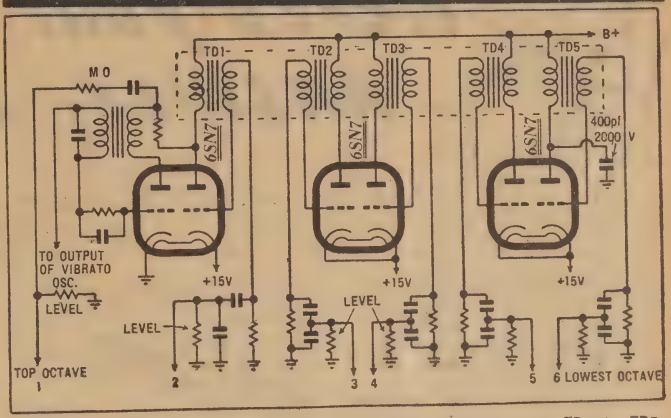
In the Baldwin instruments all the notes of the one sign are generated on the one chassis, so that we have 12 chassis in all—one containing all the C's for the organ, another all the D's and so on.

Except for variations in the tuning elements of the master oscillator



Generator circuit for the notes "C" in the Lowery organ. Values marked "X" change for different notes. The 12AX7 is the master oscillator, the 12AU7's serving as multivibrators for octaves below. The circuit is foolproof and relatively simple even if 60 tubes are used!

GENERATOR—BALDWIN ORGAN



Generators for one note sign in the Baldwin organ. Transformers TD1 to TD5 are wound on a common core; design is critical and cost about £16 for each of the twelve units required. Resistors level the outputs 1-6, the signal being very rich in both odd and even harmonics.

each chassis, all 12 of the units identical. To give the reader an of the work involved in the he construction of these units, erence is made to the circuit of one generator chassis—the C es.

n the Baldwin Model 5, 6SN7GT he valve used, 36 only being re- red for generation of all the notes both manuals and the 32 pedals, that quite a considerable saving ade in tubes when comparing the sibility of construction of this e of instrument with, say, a Conn- ata, of the same specification.

ECISION REQUIRED

he master oscillator transformer the C notes has a turns ratio of The turns ratios in this organ critical, and very little error can countenanced, particularly with divider transformers, which are tical for all the generators.

he windings for the multiple pulse nsformer are on a common core, follows. DT1 primary 3000, sec- ary 3000 (ratio 1:1), DT2 3600, 0 (ratio 1:0.97), DT3 3750, 4000 tio 1:1.1), DT4 4000, 4000 (ratio), DT5 4000, 4250 (ratio 1:1.0625).

he frequency dividers are, in mselves, blocking oscillators — ed grid type—and it is in the em- yment of this system that the ldwin organ is unique, the master illator serving as a synchronising lse to keep the dividers in step.

his detail is given for the sole rpose of showing the reader what is up against since, 99 es out of 100, the instru- nt he finally decides to build will soundly based on some success- commercial organ.

However, while commercial manu- turers are always delighted to ve general details of their pro- cts known—with the consequent dying around of the name—they ll not disclose the technological de- ls, such as sizes of inductances d values of other cmponents. This where the experimenter starts his ain of headaches, unless he is tunate enough to have access to tain manufacturers' information t normally available to the public.

TENT POSITION

Remember, too, that all these in- uments are patented and that ery facet of their generating and nal system is legally protected. herefore, to commercialise an in- ument, the manufacturer has to sure that he is not trespassing on meone else's domains and, as has en done in the Baldwin organ, he s to resort to some most unusual ectronic applications and twists in der to circumvent other established actices.

The key switching in this particu- r instrument, and now illustrated, the unique system of obviating y clicks which was mentioned rlier in this article. Key clicks in e Baldwin instrument are practic- ly negligible, and it is interesting note that the registration tablets, stops are also switched in and t by similar resistance switches.

The effect is that, at the moment making contact, there is a resist- nce of about ¼ megohm suddenly aced between the tone source and mplifier. Because of the compara- tively large value of this resistance there is only a minor voltage surge with negligible current flow: the resulting "click" is inaudible, or virtually so. As the playing key is depressed, the contacting member is flattened down, gradually, along the resistive element, thus decreasing the resistance between its two ends in a regular manner. The result is that there is a gradual decrease in resistance, thus allowing the "volume" to build up.

PLEASING INSTRUMENT

The Baldwin is a particularly pleasing instrument and, if you can make-up the divider transformers and resistance switches or have them made for you, the major obstacle in copying it is overcome.

Of a quite different circuit configuration is the Lowery organ. This organ, a postwar development, also a fully polyphonic device (that is, chords can be played), is housed in the domestic piano, without, in any way, affecting the playing technique of that instrument.

In fact, the only indication that the piano is unusual is the fact that the Organo's controls are mounted just below the front edge of the keys, these controls being six pairs of tilt-type switches which allow the performer to have the right-hand end, the left-hand end or the full compass sounding. Another pair select the depth of vibrato and others the three main types of voice — horn (strident), string (rich in higher harmonics) and the stop which the makers label "principal", but which, in the writer's opinion, has no relation to this four-foot pipe organ stop of the same name.

It is, at best, a flute-like tone with a tendency to richness in the upper harmonies. Each of these voices may be sounded either loud or soft, such choice being put into effect by depression of a "piano" or "forte" tablet.

The reason that mention is made of the Organo is that it is an instrument unknown in Australia and New Zealand, and, having no unusual circuit features, it may be assembled by the home builder with not too much trouble. However, it uses one valve per note—48 12AU7's and 12 AX7's in the model known to the writer—in the generators alone (later models use 12AU7's only).

As an indication of how simple, or otherwise, an organ design can be (and please note that the author has NOT built-up the circuit, which was obtained from the manufacturers — Central Commercial Industries Inc., 332 South Michigan Av., Chicago 4, Illinois, USA), a circuit of one frequency dividing network is shown, this being for the note C, the highest in the chain being labelled No. 1, the lowest No. 5.

SWITCH OPERATION

In common with the Minshall organ all outputs are grounded in the "off" position. If a note is to sound, then depression of the playing key removes the earth connection, thus allowing the signal from that output to go on its way to the tonecolor filter circuit, which, for simplicity, takes some beating.

A number of other commercial instruments — both British and American — follow this general pattern of master oscillator followed by frequency dividers, the resulting outputs being boosted, attenuated and filtered through degrees of R, C and L stages either singly or in combination.

The only exception is the Minshall Organ which, too, follows the above plan. However, in the Minshall, the tone-forming circuits are unique in that no resistances, capacitances or inductances are used as such in forming the tones. Without going into a detail of the theory of operation, it can be seen that here we have an organ which may be built up by the amateur with very good prospects of success — due in no small measure to the relatively cheap construction costs involved.

The cost of all tubes involved is in the vicinity of £40.

To be continued.

Here's your answer, Tom!

Many a problem has been raised and dealt with in these columns but we doubt if Tom's initial question has come up before. They say there is always a first time but we were taken somewhat aback, when Tom brought up a question, which clearly belongs to the realm of Romance.

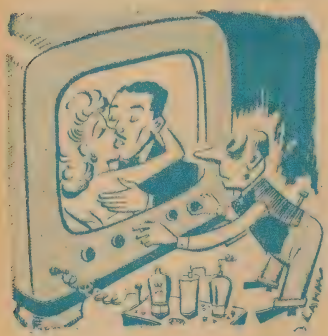
OR is it merely a spelling error, we wonder? Anyway, here it is.

Could you explain the difference between an Osculoscope and an Osculograph? And what is an Osculogram?

Of course, Tom, it may only be a spelling error. But the trouble is that there is such a thing as an "osculoscope" in the field of electronic science.

We refer to the television set, a piece of apparatus which will soon be familiar to our readers.

You see, Tom, "osculoscope" is



An osculoscope . . .!

actually a hybrid word, coming partly from Latin and partly from Greek. "Osculare" means . . . to kiss in Latin; "scopein" means to see, or in many cases, to make visible, in Greek. In other words, we have a machine which makes kissing visible!

From what we have heard of American TV programs, such an occurrence is by no means a rarity on the TV screens of that country.

Similarly the words "graphein" and "gram" mean to draw, or the drawing itself. Hence an osculograph would be a machine which draws a picture of that well known expression of affection, while an osculogram would be a permanent record made by such apparatus.

However, just in case you did get your spelling mixed up a little, Tom, we add at this juncture that there is a very similar word in Latin, "oscillare", which means to move to and fro.

Although the TV receiver is not generally known as an osculoscope, a very similar instrument is familiar to many, who have something to do with electronics. This instrument is the oscilloscope, which, as its name implies, is used to present a visual pattern of oscillations or variations in electric potentials.

After what we said previously, Tom, it should not be too difficult for you to discover that an oscillograph would be a machine which makes a permanent record of such oscillations, while the oscillogram would be the record or picture made by just such a machine.

But let us leave the realm of romance and turn our attention to questions more appropriate to the pages of this magazine. Tom's next question concerns Absorption Wavemeters and Grid-dip Oscillators, no doubt prompted by a recent article on the subject.

Could you tell me what is the essential difference between an absorption wavemeter and a grid-dip oscillator and how do they work?

Well, Tom, both instruments are actually used for the same purpose. This is to determine the resonant frequency of tuned circuits, frequently those used in transmitters. The degree of accuracy obtained will, of course, depend on how accurately the instrument is calibrated, although in most cases an approximate indication is all that is required.

We can describe the essential difference between an absorption wavemeter and a grid-dip oscillator in very simple terms: the first is actually a simple receiver with a calibrated scale, whilst the second is a simple transmitter. Let us explain a little further.

ABSORPTION WAVEMETER

The absorption wavemeter consists of a variable capacitor, a coil, and a small torch lamp, all connected in series. If the coil is brought near say the tank coil of a transmitter, current will be induced in it. Tuned to the ferquency of the transmitter, the current in the circuit will be sufficiently strong to make the torch lamp glow.

When this occurs, the frequency can be read off the dial.

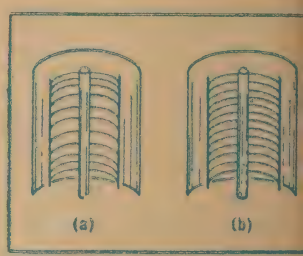
You will notice, Tom, that the power required to light the lamp is derived or absorbed from the transmitter. The instrument therefore acts as a receiver.

On the other hand, the grid-dip oscillator supplies the power its Its main components are an oscilla valve, a meter, and a tuned circ consisting of a coil and a varia capacitor. The tuned circuit, course, is used to vary the frequen of the oscillator.

The meter is connected in the g circuit of the oscillator, measuri grid current, and thereby giving dication of the strength of oscil tion. Now, the amount of pow available from the instrument very small, and if some of it is a sorbed by an outside circuit, th will be an obvious drop in strength of oscillation, indicated the meter.

The coil on a grid dip oscilla is mounted outside the instrum case, to enable it to be coupled another coil by bringing it close it. When both are tuned to same frequency (this is done varying the frequency of the osc lator) there is a pronounced shown on the meter, as power is sorbed by the outside coil. frequency is then again read from the dial.

Sometimes, as in the recent "R,



Grid construction for (a) variable-mu and (b) a sharp cut-off control grid.

& H Grid-dip Oscillator", a ma eye is used instead of a meter indicate the dip.

So much for that. And now the next question.

How does the valve enginee achieve the different character istics and cutoffs for the differ ent valve types? Does he jus sit down and work out every thing on paper, or does he de termine them experimentally

To put it bluntly, Tom, he d a bit of both. Or rather he doe lot of both! Designing of valves an extremely tricky business, and

of work has to be put into prototype, before the valve can into production.

Needless to say, today's valve engeer has all the experience gathed in the production of many usand valve types, at his disial. He therefore knows what neral type of valve will give him required characteristics, and ves himself the tremendous ount of basic research that would erwise have to be done.

Now valve characteristics mainly end on the physical placement, relation to each other, of the ve electrodes. If a request comes ough for a valve of certain chareristics, the valve engineer ects a valve of the same general aracteristics and proceeds to dify its electrode structure. The neral effect of certain modificans is known, so that he can pret that the new prototype will ve different characteristics in ne respects.

ST PROTOTYPES

A small number of the prototype made up and tested, to see if e modifications did change the aracteristics to the desired extent. ter perhaps several changes and ts the desired characteristics are hieved and a pilot batch of valves produced to see if production ethods are suitable for the new ipe.

Naturally, the valve designer has take into account whether the oposed new type can be produced thin suitable tolerances with exing facilities.

Let us say, for instance, that a signer wants to produce a valve hich, besides other characteristics, required to have a gradual cutf, or, as it is generally known, a emote cutoff". The starting point ight be a valve which has charteristics very close to those dered, but is a sharp-cutoff type.

These types have a control grid uniform pitch. In other words, ie spacing between the grid wires equal throughout the length of ie grid. Remote cutoff valves have rids which have widely spaced ires near the centre, the spacing ecoming gradually less toward the nds.

URTHER TESTS

Accordingly, the valve engineer akes up several valves, each with different grid spacing, and subcts them to tests. The one giving ne most favorable characteristics s repeated and improved further, ntil it has the required cutoff slope. ilot production runs then prove if he valve can be mass produced, nd there the designer's job largely nds.

There is no doubt, Tom is keeping up with the times. He has even iscovered that there are transisors! What more, he wants to know —anyway, here is his question:

What would be the correct value of negative grid bias for transistors?

You must still suffer from the llusion, Tom, that transistors are dentical in every respect to ordinary acuum tubes. Nothing could be urther from the truth!

We could not state any grid bias values for transistors, Tom, even if we wanted to. You see, transistors just haven't any grids. Nor have they any other electrodes identical to valve electrodes.

At the best, one could say that certain elements in the transistor carry out functions similar to valve electrodes in a triode. As a rough comparison it could be stated that the emitter corresponds to the cathode, the base to the grid, and the collector to the anode. There, however, the similarity ends.

Unlike valves, the transistor does not depend on electron passage through vacuum for its operation, but on the movement of electrons in solid matter. It is therefore understandable that their mode of operation and their behavior is vastly different from that of valves.

CORRECT VOLTAGES

However, as with valves, the voltages applied to a transistor have to be in certain relation to each other for correct operation. Hence, it would be quite futile to quote one voltage as being universally correct, whatever the other voltages may be. It would have to be calculated for any particular operating condition, with the aid of data published for any particular transistor.

We suggest you re-read some of the articles we have published recently about the use of transistors.

And lastly, here is a problem which no doubt has mystified many a budding radio enthusiast.

What do trimmers in a receiver do and how do they do it?

Trimmers, Tom, are small variable capacitors with a maximum value of somewhere between 30 and 50 pf. They are used in applications where it is necessary to have several circuits tuned accurately to certain frequencies, such as for instance the tuning circuits of a receiver.

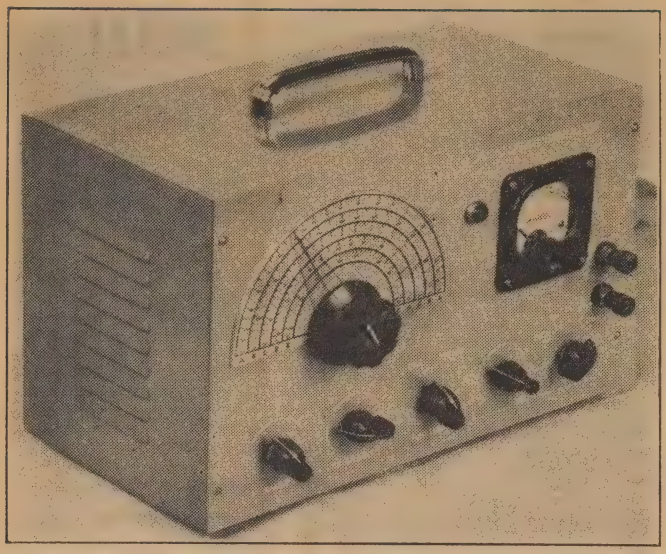
These circuits are usually tuned over a band of frequencies by means of ganged tuning capacitors, which are actually two or more variable capacitors mounted on a common shaft. Ideally these sections should all have the same capacitance.

MASS TOLERANCES

In mass manufacturing processes, however, such close tolerances cannot be achieved, and it is quite likely that you will find a difference in capacity of 2 or 3 pf between individual gang sections. Furthermore it would be quite impossible to make all connections to the gang identical, while shunt and stray capacitances across the coils may also cause considerable differences in the total capacitance of the tuned circuits.

Unless the capacitances are equal, the circuits will not be tuned to exactly the same frequency and some form of compensation must be applied to them.

This is usually done by connecting a small variable capacitor, a trimmer, in parallel with the gang sections and adjusting them until each circuit tunes to exactly the right frequency.



A photograph of the completed instrument. Our scale was in etched metal, but a celluloid-covered cardboard scale would look good.

AN AUDIO SIGNAL GENERATOR

In last month's issue we published details of a new audio generator and the considerations upon which the final design were based. This month we publish full details of the construction of the generator and the calibration procedure.

by Reg. Rawlings

PERHAPS the easiest way to tackle the actual building of the oscillator is to construct it in sections in the same order as was described in last month's issue.

The general layout of the Wien Bridge oscillator section can be seen from the photograph of the top of the unit (figure 3) and from the coded under-chassis photograph, (figure 4).

The two-gang condenser, which is a Philips miniature type, needs to be insulated from the chassis since the frame is connected to the first valve grid.

MOUNTING RODS

Our method of doing this was to obtain some 3-8in diameter polystrene rod and to drill and tap a 1-8in Whitworth hole through it, to take mounting screws in each end. Three such pieces will be required, each 5-8in long. These are affixed to the three mounting lugs on the condenser frame.

Two large holes were punched in the chassis immediately under the condenser to take the connections through the chassis. By maintaining adequate clearance between these leads and the chassis any possibility of leakage currents through poor insulating materials is avoided. Stray capacitance is also minimised.

The lead from the gang frame was soldered to the gang mounting bracket and not the actual frame, which is of a cast metal and will not take solder.

Because the gang frame is 'hot', an insulated coupling is required for conection to the control spindle. Here again, some care should be taken in the choice of the component. A ceramic type is to be preferred if available, although the moulded plastic type appear to be quite satisfactory.

The coupling should be of the flexible type to prevent strain being placed on the gang shaft. Care taken in the alignment of the two shafts will be repaid in long te stability of calibration.

The dial shaft must be bus where it passes through the fr panel and the bearing from so types of potentiometer can be pre ed into service.

As the whole of the gang has to shielded to prevent hum pickup aluminium screening box was c structed to cover the gang (see fig 2). This screen needs to be spac well away from the gang to mi mise stray capacitance.

CAPACITANCE BALANCE

This capacitance appears acr only one side of the bridge netw and, to maintain balance of the n work, additional capacitance must added to the opposite side. In so ing the ratio of the minimum maximum capacitance is reduced

This, in turn, reduces the ra of frequencies which can be cove in one range and so must be kept the minimum possible. The bala ing capacitor is the air trimm shown in the underside photogra near the rear of the oscillator co partment (figure 4).

Other types of two-gang capaci could be used but most of th generally available do not use ce mic insulation and are larger physical dimensions. The lar dimensions make it more difficult keep the stray capacitances to minimum.

The range switch used was of ceramic type to minimise leakage sistance. If a normal type wa switch has to be used several p cautions are well worth taking.

The leakage path from the t metal side screws to the switch c tacts is normally very short, the taining nuts often being in close c tact with the surface of the wa

LEAKAGE PATH

This length of leakage path can increased by fitting longer scre and using short lengths of polystr tubing on them to stand the n well off the surface of the wa The surface of the switch should clean and free of any flux depos

As the resistors used on all ranges other than the lowest w single resistors, it was conveni to wire these directly to the swi at one end. The lowest range, u two 10 megohm resistors in e section of the Wien Bridge netw and for the anchor points of the t resistors, miniature ceramic sta off insulators were used.

The preferred type of resistor these frequency-determining

ts is the close tolerance cracked-bon types. These are now becom-ly available on the local market d are well worth the additional st. Those we used were 2 pc erance but this is not so impor-nt as the fact that they should be refully matched in pairs.

The variation in their actual value ll only cause the range covered to slightly different from that with e correct values. However, if two sistors in a pair greatly differ value from each other it may set the balance of the feedback to e grid circuit and prejudice the al result.

Depending on which of the re-tors is the higher or the lower, the cuit will tend to oscillate more or ss fiercely than on other ranges. hile the automatic amplitude con-ol may take care of this, it does mit the range of control left to ke care of other variables.

ALIBRATION STABILITY

If extreme stability of calibration not essential, ordinary carbon re-stors may be used, but it would be visable to have them matched in airs to fairly close tolerances. This not only for the reasons given eviously but also to limit the drift at will take place with ageing.

When soldering these frequency-etermining resistors into circuit, are should be taken not to use ore heat than necessary to make a ood soldered joint. The changes hich are caused in resistors by eat may become a permanent hange and all the trouble taken o obtain close tolerances in the first ase may thus be rendered useless.

Care should be taken with the posi-ion of the lead from the output apacitor of the oscillator section to he function switch and also the lead ontrol. The capacitance of these eads to ground appears across the scillator circuit and should be kept o a minimum.

Not only should this value be kept mall, but held constant. For this eason a change was made in the iring after the photograph (figures and 5) were taken. Instead of sing flexible 10/010in plastic cov-ered wire for these leads, solid 20 SWG tinned copper covered with sleeving was used. This was spaced well off the chassis to keep the capa-citance low.

THERMISTOR CONTROL

The Thermistor is held in position in a small rubber grommet which is in turn held by a loop of wire around the groove. This wire is then sol-dered to an earth lug.

The Thermistor has a resistor wired in series with it to set the output level of the oscillator at about 11 volts. The value that we used was 2200 ohms, but this may vary with other instruments.

The inclusion of this resistor does not impair the amount of control that the Thermistor has in this cir-cuit and no greater changes of out-put could be detected when it was used.

The screen under the oscillator compartment was secured in position by means of three screws. These screws were tapped into three pieces of brass rod, mounted on the chassis These can conveniently be made from lengths of ¼in brass rod. Each

COMPLETE OSCILLATOR CIRCUIT

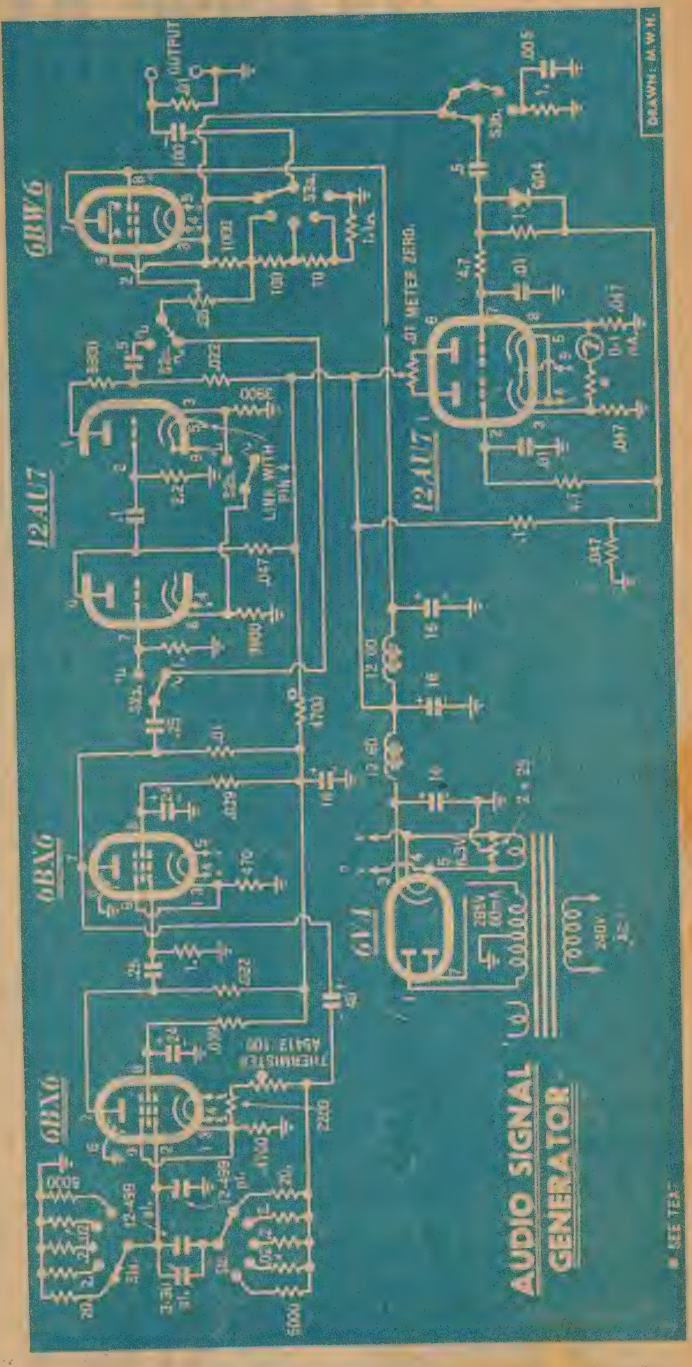


Fig. 1. The complete circuit diagram of the Audio Generator. The various sections were discussed in last month's issue and in the above circuit they are combined to give a complete instrument.

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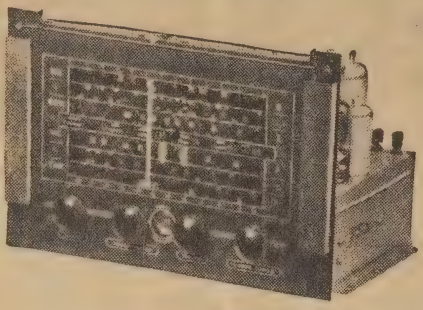

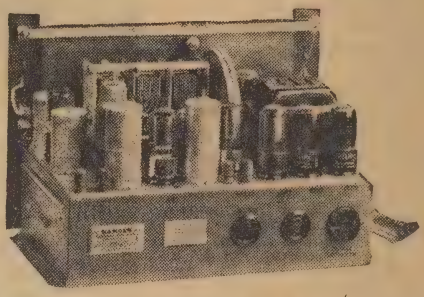

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Phone UA2145

TOP VIEW COMPLETE OSCILLATOR

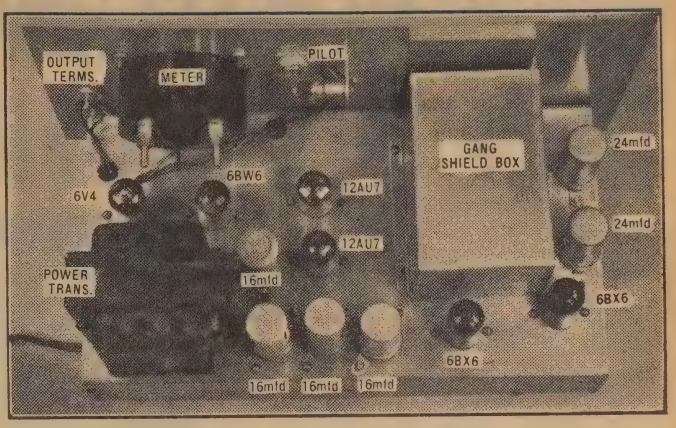

Fig. 3. A top view of the instrument showing the placement of the main components.

ce needs to be about 1-15/16in
g and is drilled at either end and
ped 1/8in Whitworth.

The rest of the oscillator section
out is quite straight forward and,
vided small components are used
d the valve sockets are mounted
the same direction, no trouble
ould be experienced.

All the valve sockets in the equip-
ent are mounted in the same direc-
n, that is with the space between
e pins one and nine toward the
cillator end of the chassis. The
lve sockets used were the mica
led ones now available.

The centre portion of the chassis
ntains the square wave shaper and
e valve voltmeter. The shaper
the nearer to the front panel to
ep the lead lengths from it to the
ne/square switch short.

MALL RESISTORS

Grid and cathode resistors are
ired directly from the valve socket
ns to earth lugs secured under one
the valve socket mounting screws.
y using the BTS type of ½-watt re-
stors very little room is taken up
y these components.

The plate loads for the squarer
ere wired from the valve socket
ins to the tag strip and on the tag
rip itself. This tag strip can be
en between the squarer and oscil-
tor sections.

The valve voltmeter is toward the
ar of the chassis and its associated
ermanium diode is wired directly
cross the tag strip between the
quarer and cathode follower sockets.
he grid return resistors are also
aken to this tag strip.

The input grid of the valve volt-
eter is switched to earth through a
megohm resistor in the extreme
nti-clockwise position of the coarse
ttenuator to permit the meter to be
et to zero. This resistor is bypassed
y a .005 mica condenser to prevent
he pick up of stray voltages on the
wo highest frequency ranges.

VOLTMETER SWITCHING

If the voltmeter is switched
directly to earth without the resis-
or the .5 input condenser is sud-
denly discharged and the meter re-
ceives a large surge current. By
discharging the condenser through
he 1 megohm resistor this surge is
imited without unduly increasing
the time the meter takes to settle
down to zero

As was mentioined in last month's
article the output of the sine and
square waves from the oscillator are
made to have equal peak value. If
the valve voltmeter was truly peak
reading the meter would read the
same for the sine or square waves
output.

However some energy does leak
away from the .5 input condenser
through the diode load and back to
earth. The result is that the volt-
meter does read some 10 or 15 pc
higher on square waves.

No components are mounted
under the filter chokes at the rear
of the chassis and in fact all com-
ponents in the instrument are readily
available if service is required at
any time.

The cathode follower stage is the
next valve along the chassis and is
the type 6BW6. The effective cathode
bias resistor in this valve is the 1000
ohm resistor. This value was chosen
to keep the B-plus drain to a reason-
able figure and also to make the
attenuator values easy.

The fine output level control im-
mediately in front of the 6BW6 and
the coarse output attenuator is the
last control along the front panel in
front of the rectifier socket.

The resistors for the coarse at-
tenuator are wired either directly to
the switch or are in close proximity
to it. The output electrolytic con-
denser is immediately behind these
resistors, and a further ceramic in-

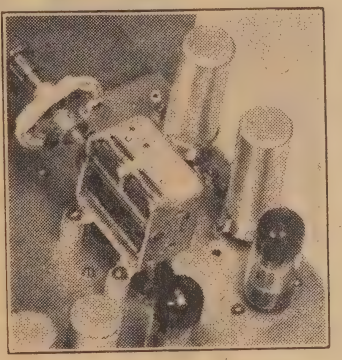

Fig. 2. Details of the gang mountings and the insulated shaft coupling are clearly shown in this photograph taken before the gang shield had been fitted.

sulating post supports one end of the condenser.

The power supply section is quite standard. Providing the upright type of transformer is used and the pair of 25 ohm resistors placed across the filament supply, no diffculties should be experienced with hum voltages and locking in of the oscillator at mains frequency or multiples of it.

No attempt should be made to eliminate the separate filter section feeding the cathode follower, as this will cause hum voltages to be fed back into the oscillator section.

As was mentioned in the first section of this article last month the whole construction of the instrument, with the exception of the case was in aluminium to avoid hum troubles. Subsequent to taking photo graphs of the instrument, a bracket was fitted to the rear of the chassis projecting downwards. When the instrument is in its case this bracket supports the weight of the power supply without placing strain on the front panel.

At this point, a word about valve types would be appropriate. As we were starting from scratch, we used those types that appeared from the data sheets to be the most suitable for the job. However there are other types which, if they are already on hand, may be suitable.

VALVE TYPES

The first limitation on valve types is their size, and it is doubtful if other than miniature types could be used in the oscillator section without changing the size and layout of the chassis. In the other positions it might just be possible to accommodate some "GT" sizes.

The valves in the oscillator section must be high-gm type television pentodes. Those used were 6BX6/EF80 which types the valve companies assure us will be standard for TV applications. Other currently available miniature types which may be satisfactory are the Z77, 6AG5 and the 6AM6/EF91.

Some of the earlier high-gm types such as the 6AC7 and EF50 might also be satisfactory if the layout is altered to accommodate them.

The requirements of the squarer stage are less stringent and the valve used is the low-mu double triode type 12AU7. A suitable substitute for this would be the 6SN7. Much the same remarks hold good for the valve voltmeter section which, in our instrument. is a 12AU7.

The cathode follower stage which,

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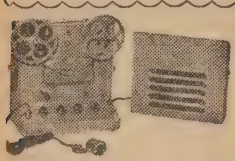

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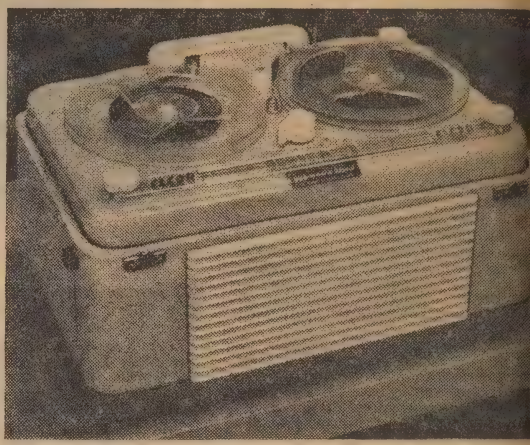

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MAGNETIC SOUND INDUSTRIES

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(Right opposite the Strand Arcade), BX4440, BX4587

our case is a 6BW6, can be any utput pentode of similar charac-ristics. The 6AQ5 miniature type the 6V6-GT could thus be used. one of the types mentioned above e of the high-gm type. In general, e have had much better results ith low gm output valves in athode-follower stages.

The rectifier valve, which is the ast critical of all, is a 6V4. How-er, types 6X4, 6X5, 5Y3, &c., would e satisfactory.

So much for the building of the scillator itself and the possible vari-ions. Now for the calibration pro-edure.

CALIBRATION

Calibration of the oscillator con-sts of comparing its output fre-uency with that of a known stand-rd. This standard may be any suit-ble oscillator covering the required anges.

Because of the wide range of our scillator, in all probability two other scillators will be needed, for ex-mple an audio oscillator to cover ne lower ranges and a RF or modu-ated oscillator to cover the higher anges. Further, at the extreme low requencies, the mains frequency can e used as a standard and at the ex-reme high frequencies a radio re-eiver can be used.

Before the final calibration is ttempted the small oscillator trim-ner capacitor must be adjusted to ive the desired frequency at the top nd of the ranges. This is best done n the range for which the most re-iable standard is available as the etting is common to all ranges and nly needs to be set on the one range.

If care has been taken in the con-truction to keep down the stray apacitances in the oscillator section his trimmer should require to be et at about half full capacitance. n this position a frequency ratio rom the low end of a range to the high end should be in excess of 10 to one on all but the highest range. Once this trimmer has been correctly set it should be sealed.

LISSAJOU FIGURES

The most convenient means of com-paring two low frequency oscillators is to feed one signal to the X plates of an oscilloscope and the other sig-nal to the Y plates. In this way Lissajou figures can be obtained and, from their pattern, the frequency ratio between the two signals can be determined.

If the pattern is a circle or ellipse the frequency ratio is 1:1. If the pattern is a figure 8, the ratio is 2:1; a three loop figure is a ratio of 3:1. After this it is much easier to note the points at which a station-ary pattern is obtained rather than count the loops. A copy of the scale obtained with our oscillator is re-printed in Fig. 7 and will give the reader an idea as to where the vari-ous calibrations should occur. While individual instruments will vary, the general scale shape will be the same.

If the calibration of the higher frequencies is being carried out using a signal generator the small mixer and demodulator shown in Fig. 7 will be of considerable help.

When the two frequencies fed to this unit are nearly identical, a beat note will be heard in the output of the audio amplifier. This will also occur when the harmonics of one of the signals is nearly identical to that of the other signal.

WIRING OF OSCILLATOR SECTION

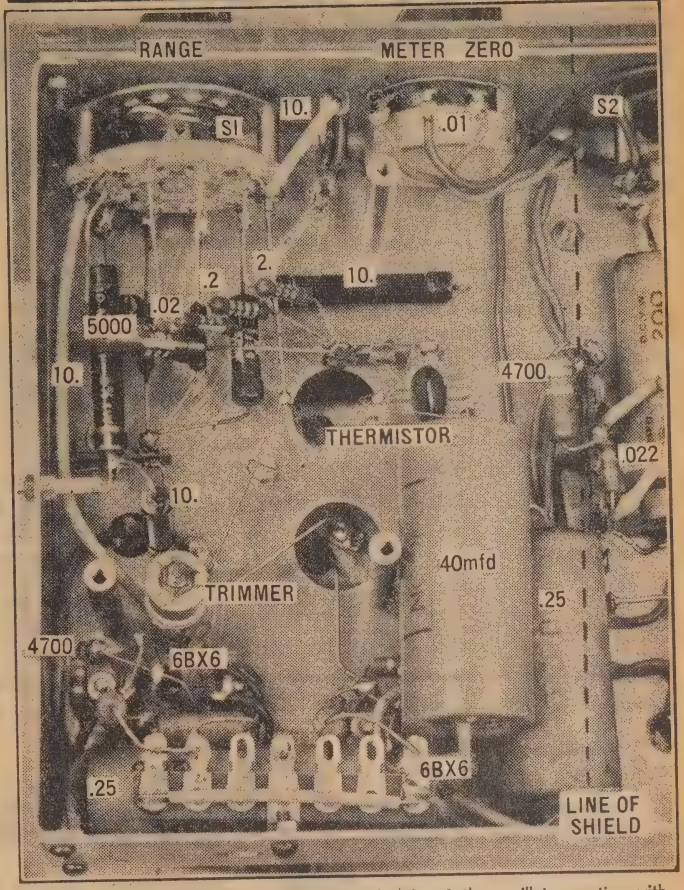


Fig. 4. A detailed photograph of the underside of the oscillator section with the shield cover removed. The large holes for the leads from the gang condenser can be seen to the left of the 40 mfd feedback condenser.

By switching the audio oscillator to the square wave output position a harmonically rich output is ob-tained. Even though the shape of the output square wave deteriorates above 10 or 15 Kcs., the squarer stage is sufficiently overdriven to produce a wave having a high harmonic content at all frequencies.

If the RF oscillator being used has a modulation switch, this should be turned off to enable the audio beat note between the two RF signals to be heard more clearly.

In the absence of a suitably cali-brated RF signal source, a radio re-ceiver can be used to tune in the output frequency of the oscillator directly or to tune in the harmonics of the oscillator output.

The coupling for the oscillator to the receiver is made by a very small capacitance. This can conveniently be done by twisting a lead from the oscillator around the aerial lead of the receiver without making actual metallic contact.

A receiver having a frequency coverage down to 150 Kcs. is par-ticularly useful for this calibration work and in our case we put into service a wartime AR8 which was ideal for the purpose.

At this point a few remarks are in order as to the method of making the dial for the instrument.

For marking the calibrations a single sided prespex curser is re-quired in preference to the one which will finally be used with the instrument. This allows the points to be more accurately marked on the white card which is fixed tempo-rarily to the instrument.

SCALE MARKING

Once the calibrations have been made on this card it can be remov-ed and marked in Indian ink. How-ever the following method gives very much improved results.

The calibrations and their fre-quencies are marked lightly in pen-cil on the card. The card is then re-moved and photographed and a print made twice full size.

On this print the points are mark-ed in with Indian ink and letters and figures from magazines cut out and stuck on to the print. Th... is

en photographed and a print made e original size. Because of the notographic reduction and the use printed letters the final result very good

We went one stage further than is and had made from the vice full-scale print, what is in fect a reverse printing block read- g the correct way. The figures and tters (which are recessed) were en filled with black wax and the rface polished and lacquered. The nal result was a very professional oking scale.

It remains now only to calibrate e valve voltmeter to complete the strument.

On test, the use of a germanium ode was found to give very good nearity in the voltmeter, even ough the full-scale deflection cor- esponds to only some ten volts.

Its small physical size makes it asy to fit into the chassis, and requires no heater supply. Its aximum reverse voltage is only 50 olts compared with much higher alue for thermionic types. How- ver, in a fixed circuit position, as this oscillator, this limiting con- ition is not reached.

If a germanium diode is used on e probe of a valve voltmeter, care ust be taken to see that it is pro- ected against accidentally applied oltages in excess of the maximum ermitted.

VOLTAGE CALIBRATION

For those of our readers who do ot have accurate voltage calibra- ion facilities, fairly good accuracy an be obtained by using a meter lready fitted with a 0-10 scale. The alve voltmeter full scale deflection s then merely set to a known 10 olts. The lower points on the scale an then be taken as near correct. This avoids the need to calibrate ach individual point and then raw up a special scale.

The resistor which sets the full cale sensitivity of the valve volt- meter is the resistor in series with he meter. In practice, the value of his is about 8-9,000 ohms, and could e made up of a fixed value of 5,000 ohms in series with a wirewound potentionmeter of the same value.

If it is desired to put in the pre- set control a small bakelite panel can be made and mounted across the rear of the meter. Once the control has been set to the desired position, it should be fixed with sealing wax or other sealing compound.

GENERAL UNDERCHASSIS WIRING

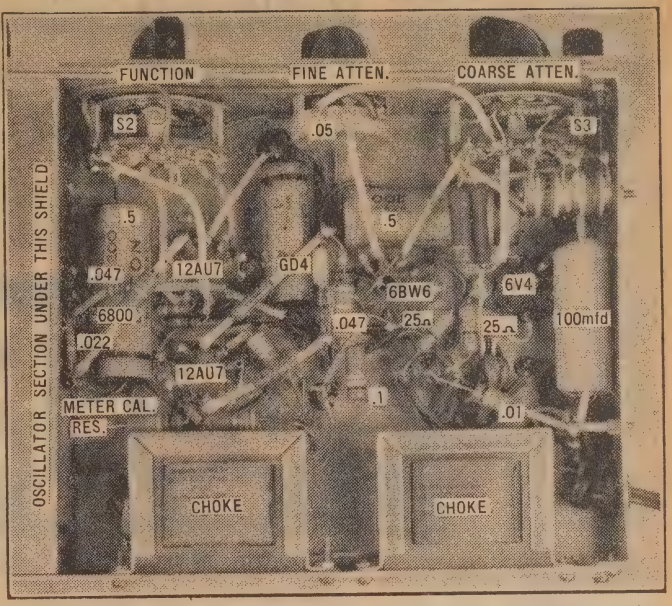


Fig. 5. A photograph of the underchassis wiring of the other circuits in the oscillator. The coarse attenuator is in the top right hand corner of the chassis with its associated resistors mounted behind it.

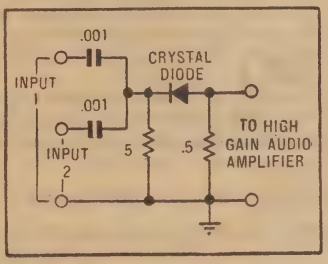


Fig. 6. The circuit diagram of the mixer /demodulator used for the calibrating of the oscillator higher frequencies.

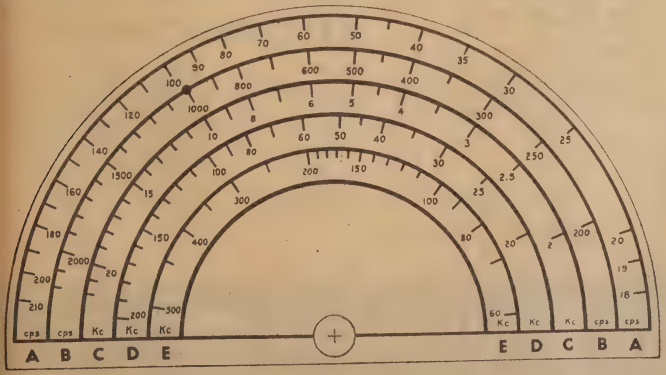


Fig. 7. This is a reprint of the scale that was obtained with our oscillator and will serve as a guide to readers when calibrating their instruments.

Whilst a 0-10 scale can be used, it is preferable to be able to read voltages slightly above 10 and also to have a db scale.

This db scale is particularly useful when adjusting the feedback on audio amplifiers. The output of the amplifier can be set to a constant reference output and the amount of feedback in the circuit determined from the db's difference in input required to the amplifier with and without feedback connected.

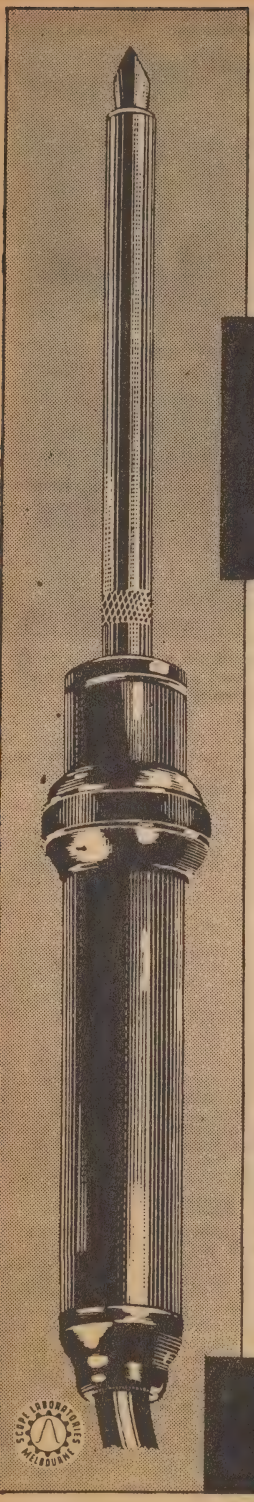
This is read directly off the meter scale in conjunction with the coarse attenuator. Each "times ten" position on this attenuator correspond to an increase in the output voltage of 20 db.

In this regard it would be well worth the trouble to calibrate the coarse attenuator in db steps also. We have taken the db zero reference points as 1 millivolt so that the times one position should be labelled Odb, the times 10 position plus 20 db times 100 position plus 40 db and the times 1000 position plus 60 db.

METER RESISTOR

We arranged the meter to read 11 volts full scale with the coarse attenuator switch in the maximum position. As this position of the attenuator is marked X1000, the scale of the meter was marked as 11 millivolts full scale. Thus at any setting of the attenuators, the output voltage of the oscillator will be the meter reading in millivolts multiplied by the coarse attenuator setting.

Once the value of meter series resistance for the required full scale deflection had been determined, this was measured and replaced with a fixed resistor of the same value, and wired in position under the chassis.



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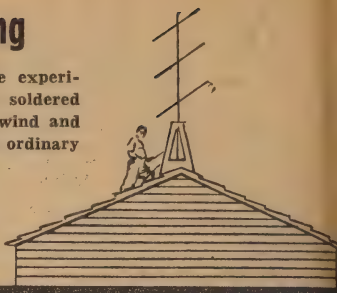

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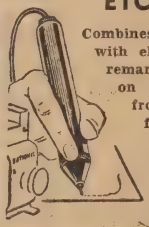

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A HIGH POWERED PLAYMASTER

(Continued from Page 41)

ke need not have more than 10 ries inductance, with a current ing of 180 mills. Its orientation s not appear to be important.

ncidentally, this 180 mill rating olies only if a tuner is used which y draw up to 30 mills. The overall in of the amplifier and control it is about 150 mills.

The amplifier itself is so arranged to proceed in a fairly balanced out from the input at the left to output at the right.

When this version was built we some indecision about the posi- ning of the first two sockets, but final blueprint will show them tred on a line which runs between two output valves.

COUPLERS

The two electrolytics near the input kets are decouplers for the control it and for the plate circuits of the st two valves. The two 5-watt istors in series make up the series istor of 10,000 ohms.

If no tuner is used this value must increased to limit the voltage pplied to the control unit to 250 lts.

The tag strip on which these resis- s are mounted also terminates ner plate and grid resistors.

Between the 12AX7 and the EL34s ll be seen the grid coupling con- nsers, the .1 condenser earthing e 12AX7 grid and the two cathode passes for the EL34 bias resistors.

The resistors themselves are car- ed forward to another tag strip so at their heat will not warm up the ectrolytics. The screen suppressors e also connected to this tag strip.

The grid resistors and suppressors r the output stage are supported on tag strip on the input side of the ckets, the cathode resistors also ing mounted here at the cathode id.

The voice coil output connection r this transformer is toward the ar of the chassis and the feedback sistor with its bypass is mounted a smal strip near it.

An even better mounting for the tput and power transformers would ve been to orientate their cores by degrees, which would have given orter plate and screen connections r the EL34s.

FILTERS

The filter condensers we used were tted with flange mountings so that eir connections came through holes the chassis. This made connections them easy.

It would be pesmissible to reduce e size of the chassis if your own omponents will allow, although you ill find it hard to cut much off any easurement if you are to avoid agnetic or heat interference be- ween the components.

When wiring the input stage see at the input lead and the cathode arth connection are made to the ame point on the chassis, to avoid a ossible earth loop which might in- roduce hum. It is quite a good cheme to use a heavy length of opper wire for common earthing.

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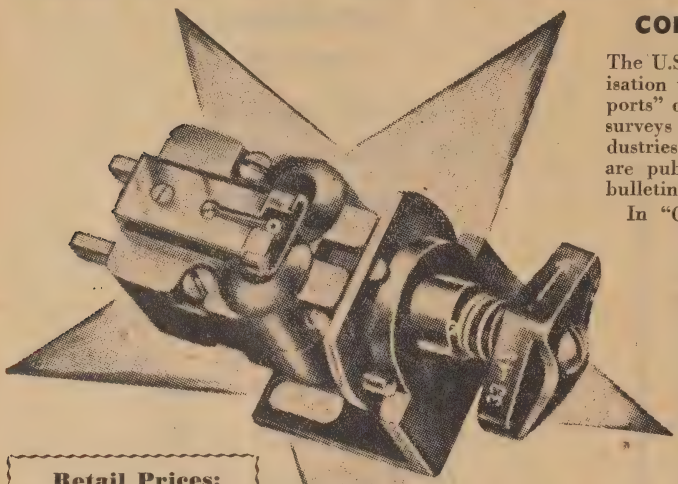

The U.S.A. "Consumers' Union" organisation which produces "Consumer Reports" carries out completely impartial surveys of the products of various industries. The results of such researches are published in the form of regular bulletins issued to subscribers.

In "Consumer Reports" June 1953 Vol. 20, No. 6, there is a special report on "HI-FI PICKUPS" in which the 26 leading magnetic and crystal pickups are investigated. Only magnetic types were found to have the frequency range necessary for High-Fidelity.

On all tests, the Goldring "500" (sold in the U.S.A. under the trade-name "Recoton Goldring "500" and manufactured in Great Britain) was placed in first position—frequency and transient response, sensitivity, translation loss, tracking distortion, intermodulation distortion, hum sensitivity, effect of warp and eccentricity, uniformity of samples—being among the factors tested.

This World Champion "Goldring No. 500" Variable Reluctance Pickup is now available for Australian "Hi-Fi" enthusiasts through leading radio houses.

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with Diamond L.P. stylus and sapphire "78" stylus £13/7/6
with 2 Diamond styli .. £19/5/-
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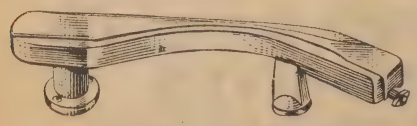

CHARACTERISTICS

Type: Magnetic variable-reluctance turn-over cartridge.
Styli: (1) .0025 in. rad. sapphire for 78 r.p.m. (green).
Styli: (2) .001 in. rad. sapphire for microgroove (red).
Normal tracking pressure: 7 grams.
Lateral compliance: Not less than 5 x 10-6 cm/dyne.
Effective mass at stylus tip: 5 milligrams approx.
Output (average): 3.2mV per cm/sec.
D.C. resistance: 4000 ohms.
Impedance: 8500 ohms at 1000 cps.
Recommended Load Resistance: 100,000 ohms.
Frequency Response: Substantially linear from 20 to 16,000 cps.

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(Full technical data and installation instructions packed with every pickup. Also available on application to Goldring Engineering (Aust.) Pty. Ltd.)

- Push-pull coil assembly cancels hum from stray magnetic fields.
- Added shielding—only the "500" contains an exclusive shield around the pole piece assembly which virtually eliminates all hum pick-up.
- Saves records—high compliance and low mass, hence excellent tracking and prolonged record life.
- Safety stylus—stylus tip automatically retracts under excessive pressure saving both the record and the stylus.
- Simple push type sapphire styli.
- Independent stylus assembly ensures precise pick-up motion.
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FROM THE SERVICEMAN WHO TELLS

At the risk of seeming monotonous I am detailing another good deed story this month. Fortunately it is a little different from my previous emergency calls. From my more regular case histories I have an unusual case of intermittent hum and set failure.

UT before delving into these technical stories I want to comment on the recent discussion in ese columns on the merits and -merits of various receivers from e servicing angle.

Since most readers appear to ve had their say I think I can irly "sum up" and perhaps add y own opinion. What started a straight out criticism against t design from a servicing angle nickly developed (as was quite atural) into criticism from both ie customer's and the service-an's angle, even though the cus-mer's case was put by the ser-ceman.

LL TO BLAME

One point appears to be quite eyond doubt. Whatever criticism ere is, it may be levelled equally gainst the better known brands nd the obscure manufacturer. Vith this opinion I am forced to gree. In fact, I sometimes feel iat the obscure manufacturer, by icking to standard practice and voiding "smart" designs, produces more reliable set than some of ie branded types.

This is particularly so in the ase of dial mechanisms. As lready indicated by readers, many f these leave much to be desired, oth in reliability and in their ctual functioning. This is mainly ecause manufacturers have tried o produce fancy dials which look ery nice from the front, but call or an unnecessarily complicated echanism.

The simple dial scores "hands lown" every time.

I also agree that pigtails twisted everal times around a solder lug re a "pain in the neck" in any-ody's language and appear to erve no useful purpose. On the ontrary they can effectively hide faulty joint which would other-vise be obvious.

CORE TROUBLE

Likewise, I have had trouble with coils using threaded iron cores n a threaded former. This idea vas used many years ago when iron cores were first introduced, but was dropped smartly when similar troubles were encountered.

However, I don't feel that the manufacturers are to blame for such things as sale of sets without an RF stage in districts which are obviously unsuitable. This is a matter for the salesman and, ultimately, the customer to decide.

In the matter of form wiring versus point to point, I imagine there may have been some confusion. Just because F.J.C. expresses a preference for point-to-point wiring I don't think it automatically follows that he condemns form wiring. Rather, I imagine, he is condemning the sloppy type of wiring job that cannot really be classified at all, at least not in print.

Also, there does seem to be a very real need for some manufacturers to study the problems of tropical operation, particularly as most sets are designed and built elsewhere than in the tropics. The experience of those men who service them in the tropics should be of considerable benefit.

Which brings me to my final point. I still think that most benefit will result from complaints to the maker, listing the faults which are apparent in any set. As one who has worked in such factories in years gone by, I have vivid recollections of the upheavals which such letters sometimes caused.

You may think you are a voice crying in the wilderness, but you may take my word for it that it doesn't take many complaints about a specific design feature to ensure that something will be done about that feature before very long.

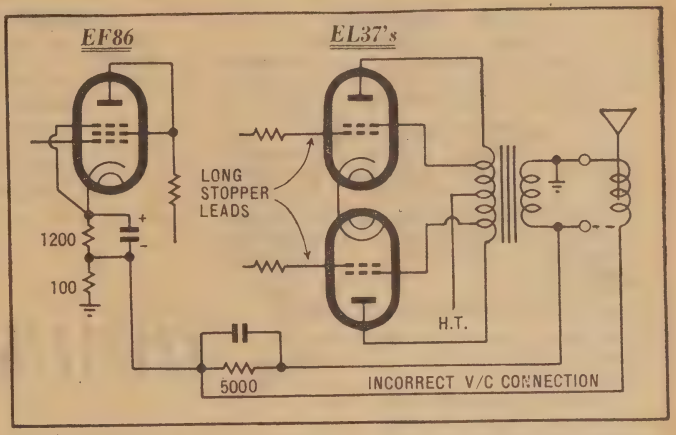
Summed up, my advice is: Complain where it will do most good. Do that and you will be making your contribution toward better radio.

GOOD DEED

My next good deed story concerns an amplifier. It all started when an acquaintance, to whom I felt I owed a good turn anyway, rang me up with a tale of woe about an amplifier he had just completed. By all accounts it was doing just about everything an amplifier should not and the builder, who was not a very experienced experimenter, was completely baffled.

I tried to get some idea of the trouble over the phone, but we didn't seem to be speaking the same language and were rapidly getting nowhere. Finally I suggested he bring it over to the family mansion that evening, reasoning that he probably had a few obvious wrong connections that could be put right without much bother. (One characteristic of servicemen is that they seem to remain confirmed optimists—in spite of experience which should teach them otherwise.)

And so it was that my friend duly arrived, complete with amplifier, which we set up on the bench and proceeded to examine. It was one of the Playmaster series (actually the No. 8 ultra-linear job), plus a No. 6 control unit. He had also brought a copy of the circuits with him.



Speaker connections like the above make it tough going for the amplifier. Although not apparent when presented in circuit form, the two terminals involved were close together on the chassis and thus easily confused. Note also the long stopper leads.

LOW OUTPUT

My friend's main complaint was that the output from the amplifier was very low and a quick check supported his statement—it was horribly low. A few seconds inspection around the speaker circuit was sufficient to reveal the cause. While one side of the speaker voice coil returned (correctly) to the chassis side of the transformer secondary, the other side connected to the remote side of the 5000 ohm feedback resistor.

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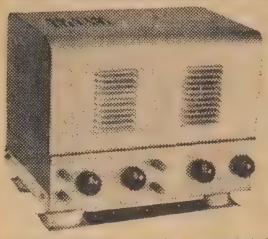

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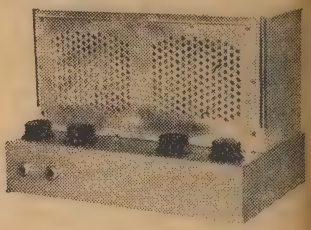

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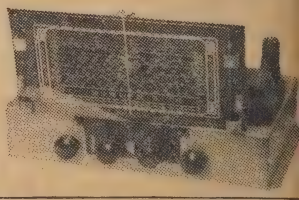

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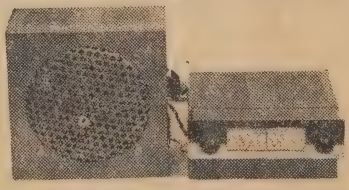

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As a result, the speaker was, in ect, connected across the 100 ohm sistor forming part of the EF86 hode circuit. Small wonder that was battling to make itself heard. e cause of the mistake was fair- obvious; the layout was such that wrong end of the feedback re- tor was closer to the speaker voice il socket. Hence it had been se- ted almost automatically.

With this point corrected, the plifier "came good" and appeared be doing all that might be ex- cted of it. However, I was far m happy with the general ap- arance of the job. My friend d purchased the correct chassis d seemed to have followed the commended layout quite careful- , at least as far as the major mponents were concerned.

Where we had gone astray, like many beginners, was in the wir- g. Most of the longer connec- ns were made in gentle sweeping escents rather than straight from int to point. Apart from its ap- arance such liberties are out of ace even at audio frequencies.

WIRING TROUBLE

Another point was the filament iring. This used about the thin- st hook-up wire available, and I d some doubts as to its suitability. fter all, the total current drain ssible, assuming a tuner as well a control unti, would be quite igh, and it would be quite easy finish up with a substantial volt- ge loss at the remote filaments.

I was also staggered somewhat y the mounting and wiring of the id stopper resistors for the EL37's. rom what I could see in the orig- al reproduced photograph (later nfirmed) the stoppers were ounted between the resistor strip nd their respective grid pins, put- ng them hard against the pins in ccordance with standard practice.

But not so in this amplifier. For ne thing the resistor strip appeared have been moved bodily toward e input end of the chassis and r another the stoppers were ounted on the strip itself. As a esult they were some three to four nches away from the grid pins.

When I drew attention to this, y friend replied that he didn't hink it mattered. Oh yes, he quite nderstood that it was not the usual ractice, but this case was differ- nt. Radio and Hobbies had in- erred, even if they didn't say it utright, that it was a naturally table amplifier. This being so, hy worry about the finer points f stopper lead length?

Presumably it had not occurred o our friend that the amplifier ould only be claimed as stable ecause of various precautions— ncluding the use and careful plac- ng of stoppers—which the designer ad the foresight to employ.

STOPPER ACCURACY

In contrast with this casual ap- proach to the placing of the stop- pers the selection of the actual re- sistors had been undertaken with considerable care. This was re- vealed when I commented that one was one of the new, very small, half-watt types, and the other an old, very much larger 1-watt var- iety. Not that it mattered, of course, but I was intrigued.

"The reason I did that," my friend replied, with a touch of pride, "was because it was the only way I could get them matched to with- in one pc."

I'm afraid I didn't have the heart to say very much, merely comment- ing that it wasn't really very criti- cal. In fact the entire value of the stopper is only equal to one five-hun- dredth part of the total grid re- sistance, or about .2 of 1 pc. On this basis the stoppers could dif- fer in value by 100 pc without hav- ing the slightest effect on perform- ance.

Truly a case of misguided zeal.

Another point which seemed to be worrying my friend was the apparent lack of balance between the two screen taps on the output transformer. He had established that they were lacking in balance by measuring the DC resistance with an ohmmeter, discovering that there was a difference of 20 ohms between the two.

He didn't volunteer in what total value this discrepancy occurred and I didn't press the point. It wasn't really important because, as I ex- plained to him, this DC resistance had little bearing on the impedance values presented by the trans- former. In the first place the im- pedance of the winding is so many times higher than the resistance, that any unbalance caused by lack of balance in the latter would be quite negligible.

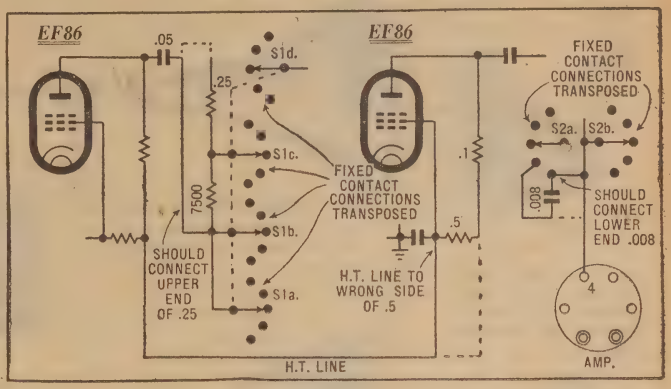
RESISTANCE AND IMPEDANCE

Secondly, it must not be inferred that a difference in resistance auto- matically means a difference in the number of turns and, therefore, a difference in impedance. There may be a different length of wire in each half due, for example, to one half of the secondary being wound over the other half, but this is not the same as a difference in impedance. Not all transformers are wound as suggested above, but there are plenty of other reasons why they may not be exactly sym- metrical in the physical—and re- sistive—sense.

Which just about disposed of the main amplifier. Although it appear- ed quite stable, I tactfully suggest- ed that the wiring might be tidied up a little and the stoppers mount- ed more logically. This my friend agreed to do, probably experienc- ing a much greater incentive now that the amplifier was working cor- rectly.

Next we tackled the control unit. This was working in a sort of a way but lacked gain, was dis- torting somewhat, and did not appear to do all the things it was supposed to do. Checking against the circuit quickly revealed two ob- vious faults. Both were in the plate circuits of the EF86's.

The first one I found was in the second EF86. In this case the screen dropping resistor was a .5 meg. and the plate load .1 meg., the junction of the two resistors running to the HT line—or so it should have been. Instead the screen end of the screen resistor connected to HT, meaning that full HT voltage was applied to the screen and the plate load was in- creased to .6 meg. The result was a set of operating conditions never dreamed of by the valve manufacturers.



The control unit was really in a mess. Any one of the faults would be bad enough; collectively they rendered it completely useless. Apart from the transposed switch connections the correct connections are shown dotted.

COUPLING CIRCUIT

The fault in the first EF86 in- volved the .05 mfd coupling con- denser from the plate to the fre- quency compensating network. In- stead of connecting to the .25 meg. resistor it connected to the lower end of the 7500 ohm resistor, that is, straight into the moving arm of one of the switch sections (S1b). The upper end of the .25 meg. re- sistor was floating in mid-air.

With these faults corrected per- formance was better, but the vari- ous compensating networks appear- ed to be tangled up in some man- ner and not functioning anything like correctly. I commenced a care- ful check of the switch connections against the circuit, starting with the bass boost and cut switch (S2a and b).

I found a small error here, the lead from pin 4 of the six pin socket running to pin 5 of the bass switch instead of pin 4, and done in such a manner as to completely short circuit the .008 mfd conden- ser. This was easily fixed.

Then I found the really big fault.

onfused by the multiplicity of ntacts on the switches my friend ad assumed that the moving con- ct belonged to the wrong bank f contacts and had thus transposed ll the connections relative to the oving arms. The first one I ound was the bass control switch S2a & b). The treble control witch, involving only a single sec- on, was correct.

With a horrible premonition I rned to the record characteristic witch (S1). Yes, you've guessed it was wrong, too, every section f it. Fortunately it was not quite bad as it seemed. Two of the ections (S1c & S1b) were joined ogether with a 7500 ohm resistor, nd so had worked out correctly n spite of the error. But that still eft the other two sections, making our in all, which had to be re- vired.

VOULD I ?

I didn't particularly fancy the job f practically re-wiring the entire witch assembly, but there seemed ittle help for it. Although my riend appreciated what he had lone and would have been quite villing to tackle the job himself, had a lingering doubt about his ibility to get it all straight.

My doubts, added to his own, ettled the question. We tackled the ob on the spot. For the most part I ound it easier to change the con- ections to the various fixed con- acts rather than the moving ones. lthough this involved more joints, t was a more logical approach, the noving contacts having been wired n such a way that a far more logical lacement of components was pos- ible when the switch was correctly vired. In most cases I had to horten pigtails rather than lengthen hem.

One idea I did not like was the arthing system adopted. Most of he components involved had been arthed to the front of the switch licker plate (presumably before it vas mounted). Once mounted it was irtually impossible to get an iron ear the joint. It so happened that one of these had to be changed, ut if they had it would have been sticky situation.

Finally it was all done and I don't ind confessing that I had really ad it. We gave it a rough check nd everything seemed to be work- ng as it should. Then I turned my ttention to a somewhat different roblem, that of the pickup.

WHY No. 6?

It was a crystal and I still have ot been able to discover why my riend chose the No. 6 Control Unit or use with it. This particular nit was designed primarily for ery low output pickups, such as he variable reluctance types. It is ar more elaborate than need be for crystal, with its initially high out- ut.

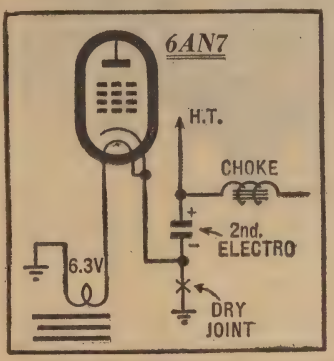
(Checking with R & H staff I find hat this is a common error among nthusiasts, in spite of the publicity given to the use for which the unit vas designed.)

The difficulty in using a crystal ickup is that it is so very easy to verload an early stage which has een designed on the basis of a nuch lower input. Where a crystal nust be used, it is desirable to pro- vide a voltage divider to reduce the pickup voltage to something more like that for which the unit was intended.

Then, of course, the valves in the control unit provide the necessary amplification to restore this lost voltage by the time the signals reach the main amplifier.

It is also desirable to remove the natural bass boost of these pickups in order that the bass boost built in to the control unit may be allowed to operate. This makes the whole scheme a lot more scientific, even if it sounds just like a crystal pickup after you've finished!

The usual arrangement is to provide a load for the pickup which is much lower than normal, thus eliminating its natural bass boost and to tap this load to provide the aforementioned voltage division.



No wonder it hummed! A faulty chassis connection caused the filament voltage to be superimposed on the HT line. It also opened the cathode circuit and effectively killed the converter stage.

I had in mind to do just this but my friend was most emphatic that nothing be done to spoil the "beautiful bass response of the crystal pickup". As a result I left the pickup working into its normal .5 meg. load and tapped this load at about one-tenth its resistance from the earthed end. As an additional precaution I added some feedback around the first EF86 (as recommended in the orginal article) thus reducing the gain appreciably.

The final result was entirely satisfactory, at least from the owner's point of view, even if it sounded like nothing any musician ever produced.

"Ah lovely, just listen to that beautiful bass" my friend sighed blissfully, as the speaker cone rocked back and forth.

NOT FOR ME

Personally, I like my reproduction a little more like the original but it's surprising the number of raised eyebrows one encounters when one diffidently suggests that the original might be used as a basis for comparison.

Along more conventional lines is the following story concerning an unusual hum trouble. The set was a four valve mantle type, of recent design (and by a well known manufacturer), and the complaint was intermittent operation accompanied by severe hum.

For once the fault was in evidence immediately I switched on. There was no sign of any signals, only a very severe hum. It was the low pitched, relatively pure hum attributable to a 50 cps source. This was important, since most hum in receivers is 100 cycle due to faulty filtering. This has a higher pitched, harsher characteristic and is not difficult to recognise with a little experience.

HANDY TIP

An ability to tell the difference between the two can often help a great deal in service work, since there is obviously no point in replacing filter components in an effort to cure 50 cycle hum, or in searching for faulty audio shielding and the like when the hum is 100 cycle.

In this case I had a second symptom to consider; the complete lack of signal. I decided to attack this first. A quick check showed approximately normal sensitivity in the IF channel and as far as the converter plate. From the converter grid there was nothing.

I pulled out the converter (a 6AN7) with the idea of testing it. The hum ceased immediately. With visions of internal shorts to the heater I didn't bother to test it, but simply plugged in a new one. The hum was just as bad as ever and there were still no signals.

At this point I commenced a more detailed examination of the stage, and after one or two routine checks I suddenly realised that the 6AN7 filament was not alight. (It is quite surprising the number of times one can be caught in this way. While going to considerable pains to check plate, screen and other similar voltages the filament circuit is invariably taken for granted. The result can be a lot of wasted time.)

Since I knew that the filament of the replacement 6AN7 was intact the fault could only be in the filament wiring. As is frequently the case in commercial sets there was only one active lead, the return circuit being through the chassis. I soon established that there was voltage on the active valve pin, thereby suggesting that the chassis connection was at fault.

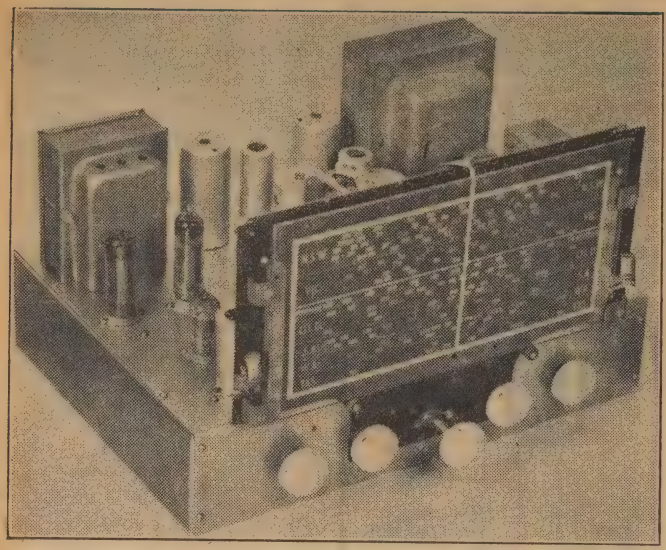
INTERESTING FAULT

Sure enough this was where I found the trouble, but its exact nature is quite intriguing. Mounted alongside the 6AN7 was the second filter condenser, a chassis mounting 16 mfd electrolytic. This was a type usually sold with a bakelite mounting plate attached and intended for use in back bias circuits, &c., where the negative side needs to be insulated from the chassis.

The mounting plate is normally held by two small lugs—both negative terminals—which pass through slots in the plate and are given a 90 degree twist. Many manufacturers, including the one who made this set, punch similar slots in the chassis, discard the insulating plate, and mount the second filter condenser directly on the chassis by the same means.

In this case both lugs had been given the aforementioned twist and

(Continued on Page 119)



A front view of the completed set. The complete audio section is on the left of the chassis, with the EF86 just behind the dial. The power supply is on the right, and the tuner in the centre. The two IF transformers and IF amplifier are at the rear. Controls, left to right are. Volume, bass, tuning, treble, and function.

AN EIGHT VALVE RADIOGRAM

It is some time since we decribed a large radiogram, so here is one to bring us right up to date. Featuring an ultra-linear output stage, flexible compensation controls, and a sensitive tuner, it gives an impressive performance on both records and radio.

by Philip Watson

THE inspiration for this set was the Ultra Linear Crystal Pickup Amplifier described in last month's issue. It seemed to us that this amplifier would make an ideal audio section for one of the larger radiograms; the type that has never lost its popularity with a large section of our readers.

PERFORMANCE

For those who want better than average results at a moderate cost, the combination of this amplifier with a high performance "front end" would be hard to beat. It is ideally suited to the crystal pickup which, with all its academic limitations, is still one of the most popular types. Used in conjunction with one of the commercial record players now available, it makes up into a set of much larger proportions than you could get for equivalent outlay on the commercial market.

There is also the advantage that all the facilities are mounted on a single chassis. This makes it a better proposition for readers who may have an existing cabinet—probably an expensive one—which they wish to retain. Again, there is quite a tendency these days to incorporate sets in built-in cupboards, room dividers, and so forth, and a single chassis will often lend itself more readily to such an arrangement than will the several chassis of the more complex gear.

For the man who has been holding off conversion to microgroove because of expense and indecision about equipment, this may well be the answer.

As a radio, the set retains the advantage of the continuously variable bass and treble compensation which, used intelligently, can overcome many of the limitations of the conventional receiver. Treble boost ma be used to offset to some extent th loss of top response due to side ban cutting in the tuner, thereby givin some semblance of wide-range re production.

On the other hand the tuner i selective enough to work in a "difficult" locations, while the to cut is always useful when condi tions are bad and noise level is hig

Bass boost can be very useful i restoring the balance of some record ed radio programs which apparentl escape the attention of the statio engineers. Bass cut is not so likel to be required for radio programs but is there, if required.

All in all then, this set shoul be able to cope with almost an form of signal, whether it originate from any of the popular crysta pickups or a broadcast station, b it near or far away.

OLDER EQUIPMENT

In designing the set we took an other factor into account. There ar many readers who already posses radiograms made before the presen era of wide range recordings, &c and who are faced with the prob lem of bringing their equipment u to date.

Most of them naturally feel disin clined to scrap their present equip ment completely and any new de sign will naturally be viewed in th light of the question, "What can salvage from my present set-up?"

With this thought in mind, w deliberately designed the chassi along fairly generous lines, leavin room for the older style valves i these should be available. The spac allowed for the power transforme and other heavy gear is also rathe liberal so that it should not be diffi cult to accommodate many of th older style units, which may happe to be suitable electrically.

SAME AMPLIFIER

As can be seen from the circuit the audio section is virtually identi cal with the amplifier described las month. The only major change i the substitution of a 5Y3 for th original 5V4 rectifier. This has th effect of reducing the HT voltage t approximately 250 and bringing th total current drain, including th tuner, into the range of a 100 mA power transformer and choke.

This size-reduction represent quite a worthwhile saving in cos as well as widening the scope o existing gear which may be salvaged Naturally, the power output will b lower but it should still be abou

ght watts, which is more than equate for home use. There is, course, no real reason why the ger power supply may not be ed, just as in the original ampli- r and, for those who prefer it, ere is plenty of room on the chassis.

For the rest, the amplifier re- ains the same as last month's, and suggest you refer to that article r any exact details on its perform- ce and operation.

Doubtless, the question will arise garding the possibility of using lves other than the EL84 (or 6BQ5) the output stage. While these are doubtedly the preferred types for e position, you could probably get vay with other high-slope valves the same circuit arrangement. alves like the KT61, 6M5 and 6BV7 ggest themselves. Check the bias sistor, however, which can be the commended valve for push-pull ntode operation, in the absence of her information.

ENTODES

If you want to try 6V6's, they had st be used as pentodes, with the propriate bias resistor and, pos- bly, some reduction in the feed- ack resistor. We are not advising ch a substitution but merely fore- alling the inevitable queries about hether it would be possible.

The EF86-12AX7 section is best left ell alone. Like all direct-coupled rcuits, it is rather more critical an resistance-coupled circuits and does not lend itself so readily to ther valve types, without careful djustment of the circuit.

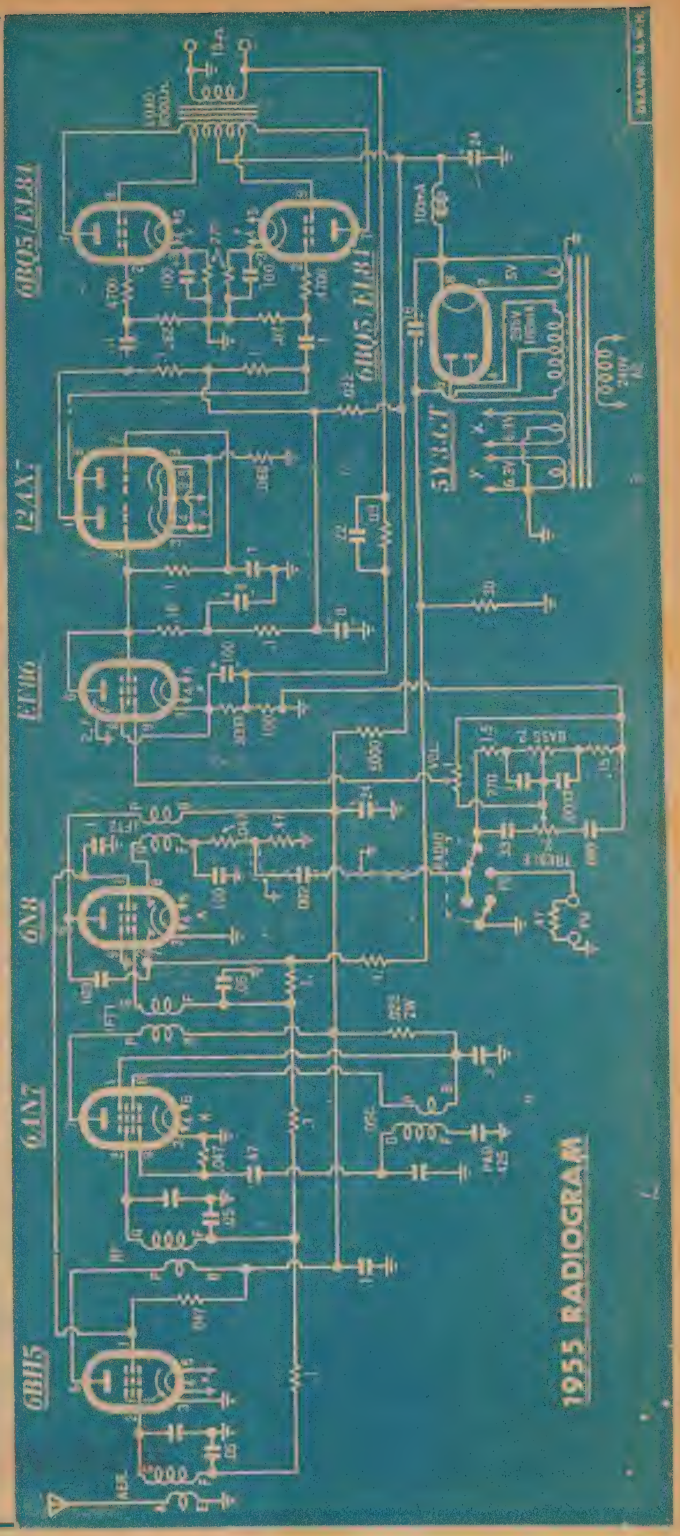
The speaker transformer is another mponent regarding which it is not dvisable to take too many liberties, one is thinking of salvaging exist- ng equipment. Of course, if it is ne of equivalent quality, well and ood, but it would be unwise to ex- ect much from the cheaper types s supplied with speakers, if the xisting feedback network is to be etained.

In some cases such an arrangement night work, particularly if the feed- ack was reduced, but each case would have to be treated on its nerits and purely as an experiment, which may or may not be satisfac- ory.

THE TUNER

For the tuner we decided that omething more than the bare mini- num was desirable in order that the et would be suitable for country as well as city use and have the videst possible appeal. Accordingly, ve included an RF stage and the xtra gain and selectivity should nake available any signal which is trong enough to get through the natural noise level.

As an RF amplifier we used the BH5, a moderately high-gain valve which gives good performance with- out too much risk of instability. The



This circuit shows how last month's amplifier is combined with a sensitive tuner to produce a first class radiogram. Note the changes to the power supply which include the substitution of a 5Y3 rectifier, smaller power transformer and choke, and back bias for the tuner.

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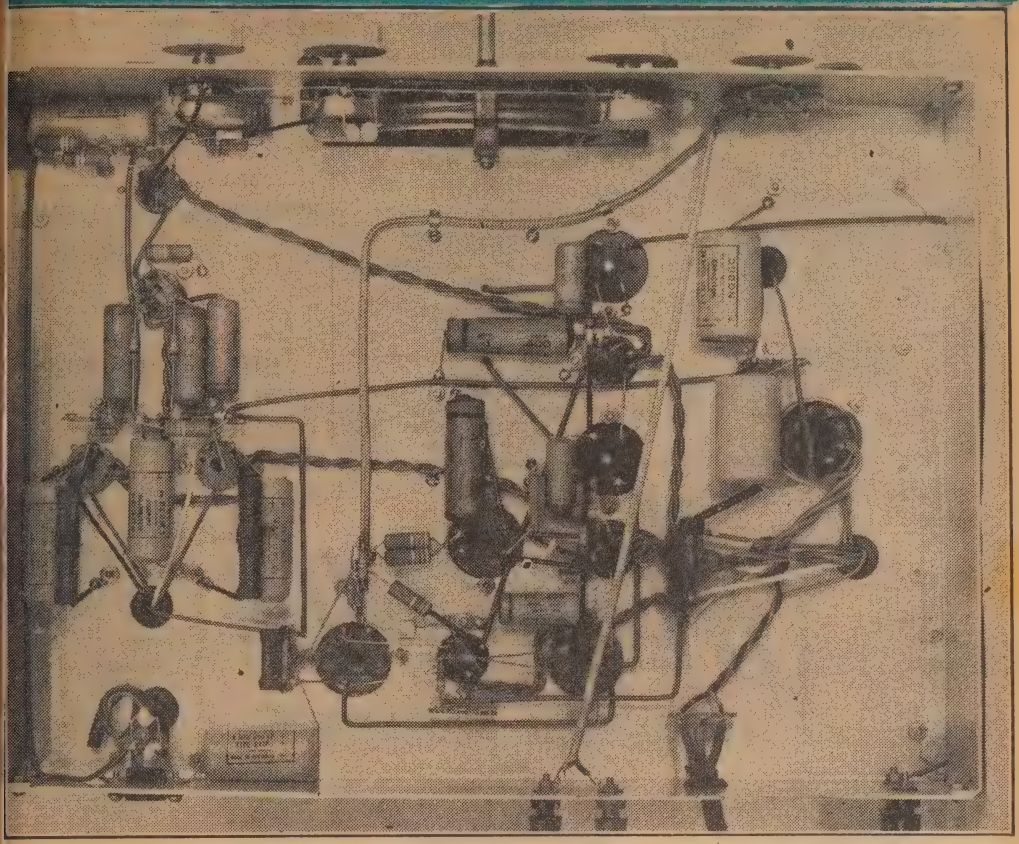
KINGSLEY RADIO

UNDER CHASSIS VIEW OF EIGHT-VALVE RADIOGRAM



There is plenty of room under the chassis and no need to crowd the parts. The audio section is on the left with the EF86 at the top. Above it is the volume control, then the bass control, tuning, treble, and function switch in that order. In the finished chassis these controls are enclosed by a shield panel to minimise hum.

AN7 is one of several possible hoices for the converter stage, while 6N8 is an almost automatic choice or the IF amplifier, which must also rovide AVC and detection.

Older type valves could be used ere, such as the 6SK7, X61M and AR7, or the 6U7, 6J8 and 6G8, or ombinations of these. The only hanges, apart from the physical ones, vill be to the grid and screen volt- ges in certain cases.

Assuming that such valves are be- ng salvaged from older gear, it is ikely that the appropriate oscillator oil will also be available. These valve suggestions are by no means he only types that could be used, hough they are the most likely.

Back-bias is used throughout the ront end, providing bias for all three tages from a single resistor. The lternative would be a separate bias esistor and by-pass capacitor for ach stage, making for higher cost nd greater circuit complexity with- ut adding anything to the perform- nce.

As it is, it is only necessary to dd a 30-ohm resistor to the trans- ormer centre tap and return the irst electrolytic negative lead to the

PARTS LIST

1 chassis 14 x 10½ x 3in.
1 dial USL46 or similar. Suit gang.
1 power transformer 285v. 100mA. 5v 2A. 6.3v 2A. 6.3v 2A. CT.
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CAPACITORS

2 100 mfd 40VP Electros. 1 100 mfd 12 VP Electro. 2 24 mfd 525V Electro. 1 16 mfd 525 Electro. 2 8 mfd 525V Electros. 6 .1 mfd 400V paper 3 .05 mfd 200V paper. 1 .002 400V paper. 1 .0033 mfd mica. 1 680 pf ceramic. 1 425 pf 5% mica. 1 270 pf ceramic. 2 100 pf ceramic. 1 47 pf ceramic. 1 33 pf ceramic. 1 22 pf ceramic. 1 3 gang tuning capacitor, midget or standard.

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nearthed side of this resistor. This
n no way effects the bias of the
udio amplifier stages, which operate
s before.

We spent some time working out
chassis and layout which would
e reasonable in size and yet versa-
le enough to accommodate older-
yle components. The result is a
nassis measing 14in x 10½in x 3in,
hich is not over-large for a set of
his type. We used standard size
oils and left enough room for the
arger valves, if they are preferred.

The lay-out may be considered in
hree sections. On the left is the
mplifier, in the centre the tuner,
nd on the right the power supply.
he layout of the amplifier is virtu-
lly identical with that used for the
riginal version last month (exclud-
ng the power supply), and the four
ontrol knobs are distributed along
he front of the chassis in the same
rder.

TUNING CONTROL

The only difference here is that
he controls are spaced to make way
or the tuning control, which is
ocated between the bass and treble
ontrols. As with the original am-
lifier, the controls, their associated
viring, and the EF86 stage are all
rranged so that they may be en-
losed by a right-angle shield run-
ing the length of the chassis. This,
vith the top and front of the chassis,
orms a box which completely en-
loses this section.

To keep the tuner components
lear of this section it was necessary
o move them back a couple of inches
rom the front of the chassis. This
ncludes the gang and this is coupled
o the dial drum by means of a
-8in to 3-8in extension shaft. If a
arger type gang is contemplated,
here should be plenty of room to
ccommodate it by allowing the front
o approach closer to the dial. An
xtension shaft may or not be re-
uired, according to the particular
ype.

In order to locate the controls
uitably and also space them equally,
t is not possible to use the holes
riginally provided in the dial plate.
nstead we had to modify the plate
lightly and cut two new holes in the
nounting slots near each end. This
llows all controls to be spaced
qually 2 1-8in apart.

ORDER OF CONTROLS

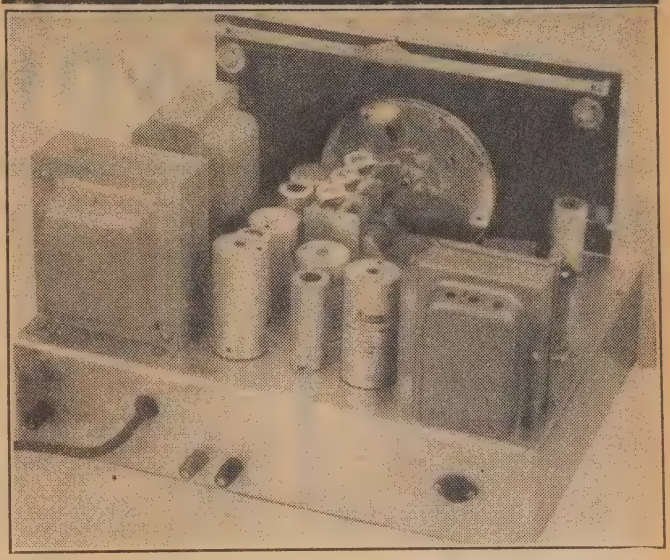
The volume control is on the left,
losest to the EF86, then the bass
ontrol, tuning, treble control, and
he radio/pickup change-over switch.

The aerial coil, the 6BH5, and the
RF coil are mounted alongside the
gang, with the oscillator coil at the
ear. The sections of the gang are
sed in the same order. The 6AN7
s directly behind the RF coil and
he IF transformers and the IF
mplifier run parallel with the rear
of the chassis.

Orientation of the valve sockets
is important and they should be
mounted as follows, using the gap
between pins as the reference. All
the amplifier valves toward the
nearby end of the chassis, the exact
position being indicated by the
chassis, the 6AN7 and 6N8 toward
the oscillator coil, and the 6BH5 to-
ward the gang. The rectifier is not
critical.

With the sockets laid out as above
the coils may be quite easily mount-
ed to provide minimum length for
the critical grid and plate leads. The

RADIOGRAM—VIEW FROM REAR



On the right is the output transformer, on the left the power transformer and choke. Left of the gang is the aerial coil, RF valve, RF coil, and converter in that order from the front of the chassis. Oscillator coil is behind the gang.

HT and AVC leads are less critical, being "cold" by reason of their respective bypass capacitors.

Two leads which can be quite critical are those from the AVC diode (pin 7) to the two one megohm resistors of the AVC circuit. The diode ends of these two resistors are "hot" at RF, while the opposite ends are "cold", being bypassed. It is important, therefore, that these two resistors are mounted as close as possible to the diode pin.

RESISTOR PLACING

In our case the load resistor (running to the back bias resistor) is mounted between the diode pin and a terminal on a three tag terminal strip mounted under the 6N8 rear socket bolt. The decoupling resistor runs direct to the AVC pin of the first IF.

There are a number of terminal strips used in the set and they help to support the smaller components in a logical manner. As in the original amplifier, an eight terminal variety is used to accommodate the grid stoppers for the EL84's, one end of the coupling capacitors, one end of the plate load resistors for the 12AX7, the .022 meg. decoupling resistor, and the positive end of the 8mfd decoupling capacitor.

In the grid circuit of the EF86 two terminal strips support a number of the compensation circuit components. A seven terminal type is used for the .1 meg. decoupling resistor, the EF86 plate load resistor, and the 8 mfd decoupling capacitor.

A five-terminal strip accommodates the EF86 3300 ohm cathode resistor, the 100 mfd by-pass, the 100 ohm cathode resistor and the 680 pf capacitor in the compensation circuit. The earthed terminal also serves as the single earth point for this section, as indicated in the circuit. As explained last month this procedure is advisable to minimise hum problems.

A three terminal strip is secured under the second IF transformer mounting nut and supports the 5000 decoupling resistor. Also near the second IF transformer is an eight-tag strip which supports the .047 diode decoupler, the .47 diode load, one end of the 100 pf bypass, and the .002 mfd diode coupling capacitor. It also provides a HT terminal from which the .047 meg. screen resistor and the .011 meg. oscillator plate resistor are taken.

Note that we have omitted the 100 pf capacitor which normally bypasses the "hot" end of the diode load. Using ordinary good quality shielded hook-up wire, there should be enough capacitance to simulate this capacitor, but it may be fitted if there is any suggestion of RF instability in the audio system.

TRANSFORMER LEADS

A three-terminal strip is used to terminate the power transformer primary leads and the power cable. A five terminal strip terminates the filament leads and the secondary centre tap as well as supporting the 30 ohm back bias resistor. A three-terminal strip near the rectifier socket terminates the choke leads and the positive leads from the main electrolytics.

The remaining minor components may be supported between terminal points of larger ones, using their own pigtails.

Before commencing the wiring proper it is a good idea to carry out some preliminary wiring on the valve sockets. This consists of determining those pins which will have to be eathed, such as the

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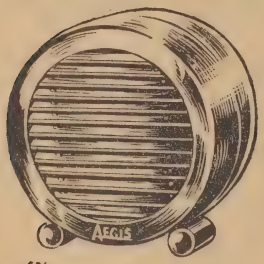

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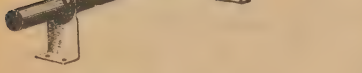

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athode, suppressor, &c., plus the entral shield, linking them together with 20g tinned copper wire and arthing them to a solder lug under ne of the socket mounting nuts. Where a steel chassis is used, it is a good idea to link all these earth lugs ogether and not rely on the chassis.

There are two filament runs, one or the EL84's and 12AX7 and the ther for the EF86 and the tuner alves. Both are made with twisted ookup wire and the one for the F86 circuit should use the centre-apped winding. The other winding s simply earthed at one side.

WIRING

For the shorter connections, as etween coil and socket pins, 20g inned copper wire is most satisactory and will not need insulating leeving except in odd cases. Other iring, HT runs, and so forth, may e made in plastic hookup wire.

The aerial lead is best kept clear f the RF and IF stages and should e taken straight across the chassis o the right-hand side, through a mall hole in the side and along the utside of the chassis to the rear. ere it enters the chassis again for n inch or so to connect to the aerial erminal on the rear.

Two other terminals on the rear f the chassis provide for pickup onnection and a shielded cable runs rom them to the function switch. As entioned in the article on the ampli-er it is necessary to provide a suit-ble load for the pickup, a common alue being .5 meg., but varying with ifferent types and individual re-uirements. The optimum value is est determined by experiment and ay be mounted on the function witch.

The final testing and adjustment f the set does not present any par-icular problems. As with all ampli-ers employing voice coil feedback is necessary to determine the cor-ect polarity of the voice coil circuit efore a permanent connection is ade. Connection to one side will ause the amplifier to oscillate and s obviously the wrong one. Con-ection to the other side will cause noticeable drop in gain, indicating egative feedback.

For this reason this connection is est left until the amplifier is func-ioning and the correct polarity etermined experimentally. The iring may then be made permanent.

RIAL RUN

Unless there is some major defect ither in the wiring or a component he tuner should produce some kind of ignals immediately it is switched on. deally one should be in a position t this stage to connect it to a service scillator and complete the alignment n the approved manner.

Even if this cannot be done im-ediately it should be the ultimate im, since best results are not likely o be achieved otherwise. However, s a temporary measure, it is possible o improve performance using the imple "alignment by ear" technique.

The IF transformers as received rom the makers should be adjusted airly close to the correct frequency. hey should only require slight ad-ustment, mainly to offset the stray apacitance of the associated wiring, robably amounting to one turn at he most.

(Continued on Page 103)

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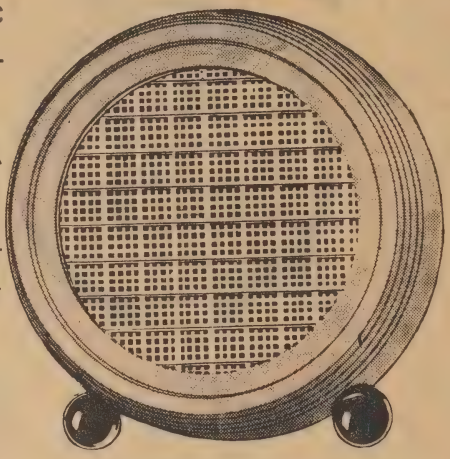

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WHY ELECTROSTATIC SPEAKERS?

Great interest is being shown at the moment in the development of electrostatic loudspeakers both for high frequency and full-range use. This article has been contributed by a world-famous designer of audio equipment.

by

H. J. Leak

M. BRIT, I.R.E.

WHERE appears little doubt to the author that the 30 years' supremacy of the moving-coil loudspeaker as a high-frequency reproducer is ending, and that it will be displaced by a particular form of electrostatic loudspeaker.

This opinion is based on engineering experience of the inherent limitations of moving-coil systems during these 30 years, and on intensive study and development of electrostatic loudspeakers.

It also appears that the moving-coil loudspeaker will stay with us as a bass reproducer, for which purpose it seems better fitted (when properly designed) than any foreseeable practical alternative.

Let us first consider the inherent faults of conventional moving-coil loudspeakers as high-frequency transducers. These faults are ineradicable because they arise primarily from the physical properties (which are limitations) of the materials available for use in the operating parts (paper, copper, aluminium, &c.), and secondarily from the mode of operation and the relative disposition of these parts (speech coil, diaphragm, surround).

MOVING COIL SPEAKER

Consider the structure of a typical small moving-coil cone loudspeaker. We know that modern feedback amplifiers can deliver an almost undistorted electrical signal to the speech coil, and our wish is to obtain a correspondingly undistorted acoustical signal as the result of the mechanical movement of the coil and diaphragm.

For this to be possible we can state with certainty that the moving parts must:

(1) move as a rigid whole, i.e. without flexing;

(2) move instantaneously with the changing electrical signal;

(3) move proportionately to the magnitude of the electrical signal, irrespective of frequency.

Now 1, 2 and 3 above imply that such a loudspeaker will be a linear device and will not produce harmonic or other spurious frequencies, that it will have perfect "transient response" and freedom from "hangover", and that it will have a "flat" response, on and off the axis, up to a frequency whose wavelength is related to the cone dimensions.

Unfortunately, 1, 2 and 3 also imply that the moving parts will be mass-less and also infinitely rigid (i.e. of infinite internal stiffness).

Alas, weightless and infinitely stiff materials have not yet been invented! Small cone loudspeakers are, therefore, somewhat short of perfection; how short may be gauged from Figs. 1 and 2, which are frequency response curves taken under conditions laid down by the British Standards Institution.[1]

The 5in loudspeaker is more expensive than the elliptical; both have aluminium voice coils, and both are representative of present-day performance. The irregularities in the response curves are due to:

(1) the mass of the voice coil resonating with its own compliance (the reciprocal of stiffness); and

(2) the cone breaking up and vibrating in unpredictable modes.

The only way to improve (1) is to make the voice coil as light and stiff as possible so that resonance will occur as high in the frequency scale as possible. The only thing that can be done about (2) is to make the cone stiffer, and to do this (using the same material and without reducing its size) we must increase its thickness and therefore weight, when the loudspeaker's sensitivity and range will be restricted.

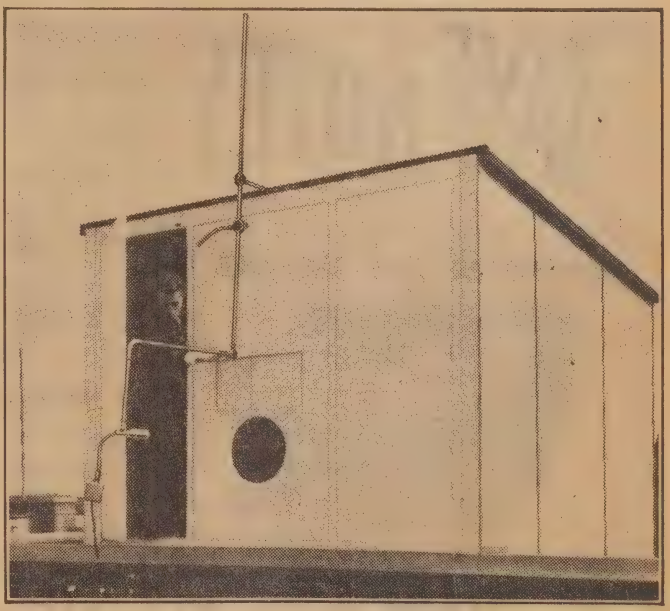
If we reduce the size of the diaphragm in order to make it stiffer it will then not move enough air to be an efficient radiator unless it is coupled to a horn. These are exactly the reasons why horn tweeters are made, and why they have a flatter frequency response (when well designed) than direct-radiator cone loudspeakers. Unfortunately, horns introduce distortions.

It is important to know that the sharp hills and valleys in the response curves are provenly indicative of a poor response to transient signals and of a slow decay time (hangover).[2]

NOT REALLY GOOD

To sum up, moving-coil cone loudspeakers have an irregular and restricted high frequency response and a poor transient response because the moving parts are too large, too heavy, and not stiff enough.

The aspect of "not stiff enough" which is important is that the mechanical driving force originating at the speech coil is mechanically re-



The loudspeaker curves shown here were taken out-of-doors. Note the microphones, one on the axis and one 30 degrees removed.

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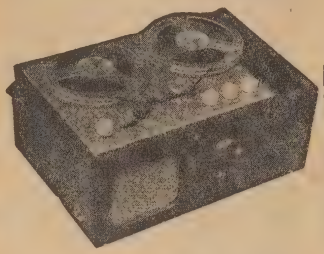

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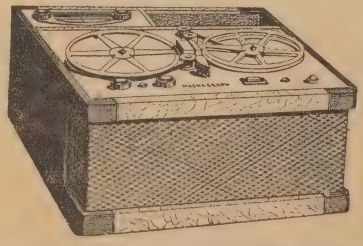

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te and mechanically decoupled n the main area of the radiating phragm. The movement of the iating diaphragm is, therefore, completely controlled by the trical signals delivered to the ; hence the distortions in the nd output.

low let us consider the only type moving-coil loudspeaker which s not possess the above inherent its to anything like the same ree.

he ribbon loudspeaker has a le of operation essentially dif- nt from the cone loudspeakers viously discussed because the hanical driving force is applied nly over the whole area of the phragm.

t will be observed (see Fig. 3) t this diaphragm is extremely ht, being made of foil approxi- tely 2in long by 3-8in wide and y a fraction of one-thousandth of inch thick.

lotice that the diaphragm is ually the "moving-coil", and that it will obviously not be infinitely ff. Now, this is a very important nt indeed: the diaphragm does need to be infinitely stiff be- se it is forced to move by the trical signal as if it were in- tely stiff.

BON SPEAKER

ig. 4 shows the frequency re- nse of the developed ribbon dspeaker illustrated in Fig. 3. In author's opinion the ribbon eter has been the most faithful dspeaker transducer until the ent of the new electrostatic dspeakers which we are soon to cuss.

he ribbon loudspeaker must, of rse, employ a horn, in order to ve an appreciable amount of air t the magnet will be expensive if loudspeaker is to have an iency comparable with its asso- ed woofer. A ribbon loudspeaker h as that illustrated is rather ile as regards the moving parts would cost around £45. These the two main reasons why the del has not been put into produc- n.

t would appear from the above t what we really want is a system ilar to the ribbon system, in its ential of a light diaphragm forced ove as a rigid whole, but having liaphragm many times the area that it can radiate directly with- a horn.

his would be quite impracticable stepping up all the dimensions the above ribbon tweeter, for the magnet would be of great size, weight and cost (certainly some hundreds of pounds).

But there is another way of electrically forcing a very light flexible diaphragm to move as a whole and to follow very accurately in its mechanical movements the electrical signals supplied from the amplifier. Furthermore, the diaphragm can be large; and this is where we come to electrostatic loudspeakers.

PERFORMANCE LIMITATIONS

Electrostatic loudspeakers have been under development for some 30 years, but have not been generally acceptable because of their performance limitations. Comparatively recently these limitations have been largely removed by the development of new materials and techniques, coupled with the conception of ideas. It will greatly help us to grasp the significance of these new developments if we consider the basic form of the earlier electrostatic loudspeakers, pictured typically in Fig. 5.

The isolating capacitor merely serves to prevent the transformer short-circuiting the polarising potential applied across the rigid plate and the moving foil which comprise the actual electrostatic transducer.

The high resistance may be several megohms in value because no current is drawn from the polarising source by the loudspeaker, which can be seen to be a capacitor ("condenser"). This resistor also prevents the transformer being loaded by the source of the polarising voltage. This voltage will be several hundred volts or more, and in practice will be derived from the supply

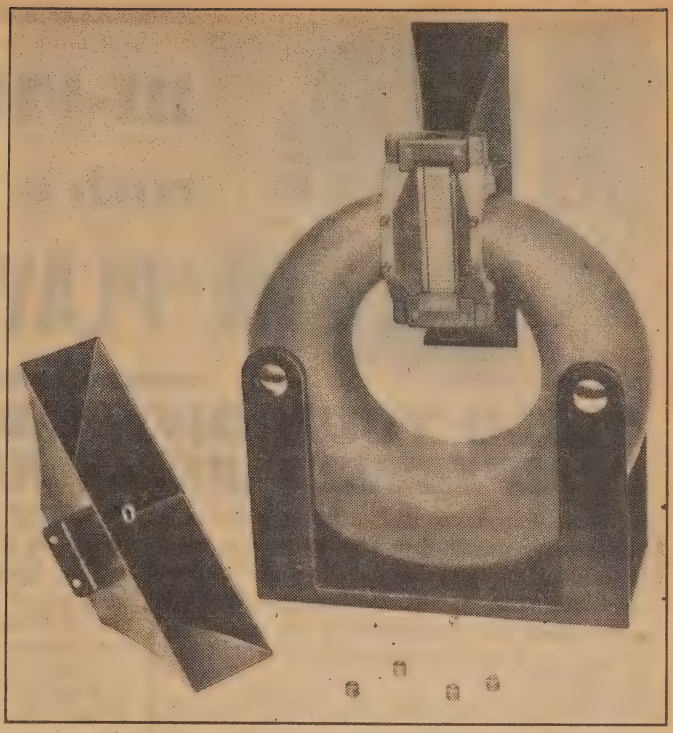

Fig. 3: A ribbon type tweeter made by Leak with the horn removed.

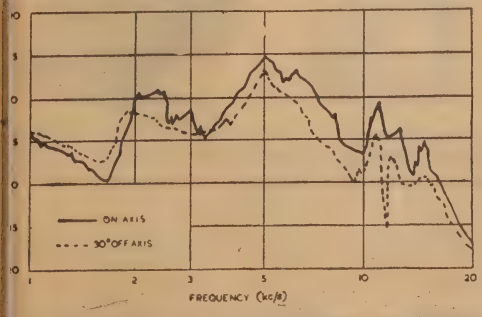

Fig. 1: Frequency curve of 5 inch cone tweeter with aluminium voice coil.

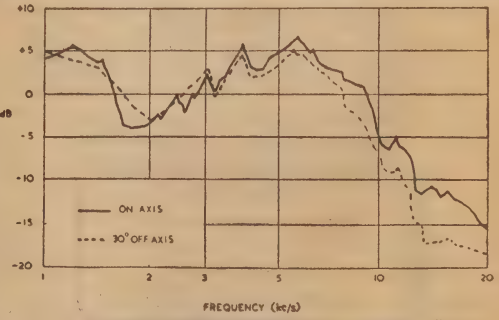

Fig. 2: Frequency response curve of 6 x 4 inches elliptical tweeter with aluminium voice coil.

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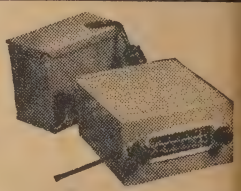

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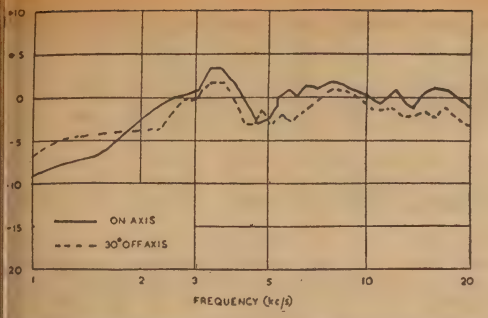

Fig. 4: Frequency response curves of ribbon tweeter illustrated at Fig. 3.

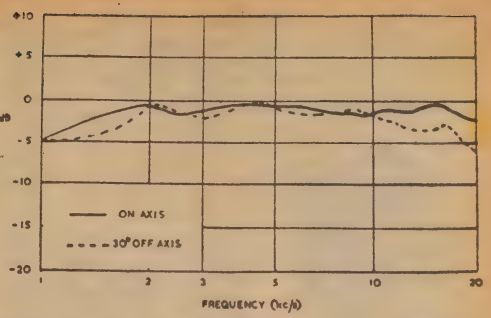

Fig. 8: Frequency response curves of the balanced push-pull electrostatic speaker illustrated at Fig. 7.

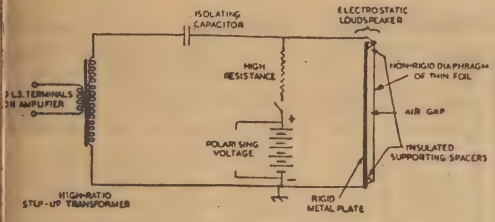

Fig. 5: Schematic drawing of single-sided electrostatic loudspeaker.

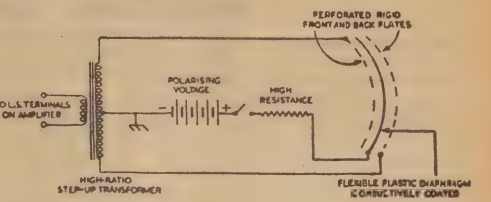

Fig. 6: Schematic drawing of balanced push-pull electrostatic loudspeaker.

ains, but for simplicity a battery shown in Fig. 5.

The air-gap between the rigid ate and the diaphragm will be of e order of a few hundredths of inch.

The area of each plate will be lated to the lowest frequency hich the loudspeaker is expected reproduce efficiently; a few square ches will suffice to cover the range om, say, 8 kcs upwards, but to tend the range downwards to, say, 00 cs will require something more an a square foot.

Whatever may be the dimensions d spacing of the plates, we can lculate or measure the capaci-nce between them, and in practice will range between a few hun-reds and a few thousands of pf. is value will give us the imped-ce range of the loudspeaker, which haves as a capacitive reactance. e can now design our step-up nsformer to give optimum match-g between amplifier and loud-eaker.

We should now have a fair idea of e circuitry, construction and mensions of what is called a single-ied electrostatic loudspeaker, and e can proceed to examine its modes behavior, referring again to Fig.

T-UP TRANSFORMER

Assume that the high-ratio step-transformer is temporarily dis-nnected from the amplifier. If the larising voltage is now switched to circuit a potential will build across the rigid plate and the sulting electrostatic force of attrac-n will cause the thin diaphragm move toward the rigid plate.

If this flexible diaphragm is not nstrained, as by stretching, it will viously move into contact with the gid plate. If the diaphragm is nsioned sufficiently to prevent this llapse, then it will take up a posi-n of equilibrium whose location with respect to the rigid plate will be determined by the ratio of the forces contributed by the polarising potential (toward collapse) and the diaphragm tension (against collapse).

It can be shown, experimentally and mathematically, that to ensure stability the diaphragm must not be pulled toward the fixed plate more than one quarter of the distance which separated them before the application of the polarising voltage.[3]

If we now connect the high-ratio step-up transformer to the amplifier the electrical signals from the latter will cause the diaphragm to move back and forth about the equilibrium position, so producing a sound output. Our immediate interest is the degree of faithfulness of this sound output, which depends on how accurately these backward and forward movements duplicate, mechanically, the positive and negative half-cycles of the electrical signals which cause them.

SMALL DIAPHRAGM

It must suffice to say that it can be shown, experimentally and theoretically, that the degree of duplication is poor (i.e. the distortion in the sound output is high) unless the amplitude of movement of the diaphragm is kept very small.[3] This means that the sound output is small, and the loudspeaker is therefore effectively too inefficient to be of practical interest.

There are also other disadvantages arising from our stipulated construction:

(a) The layer of air trapped between the diaphragm and the rigid plate adds to the non-linearity of the system.

(b) The foil diaphragm will be too heavy to follow quickly the electrical signals if it is made thick enough to obviate extreme fragility, and

(c) temperature changes will affect the tensioning of the thin foil diaphragm; a drop in temperature will stiffen it, and a rise may expand it sufficiently to cause the polarising potential to arc across the reduced air-gap.

Therefore, our basic single-sided electrostatic loudspeaker does not appear practical as a high-fidelity reproducer, and this conclusion is confirmed by every engineer who has labored on this project.

But engineers are apt to think deeply and work hard on those problems which are theoretically attractive, and as the result of many years' development there has been evolved a form of modern electrostatic loudspeaker whose performance is markedly superior to that of other types.

BALANCED SYSTEM

We will jump the slow progressive stages of its evolution and proceed to examine the basic form of the balanced-push-pull electrostatic loudspeakers which have recently been developed.

It will be seen that Fig. 6 bears some resemblances to Fig. 5. We still have the high-ratio step-up transformer, the high polarising voltage and the high resistance, but the actual loudspeaker elements are quite different, and we can state their basic features as under:

(1) The thin, flexible diaphragm is a sheet of extremely tough plastic material, having a negligible co-efficient of expansion as regards temperature, and coated with a conducting material which is so thin that it does not materially add to the weight of the diaphragm. The thickness of the diaphragm is a fraction of one-thousandth of an inch.

(2) The thin diaphragm is held by a system of insulating spacers

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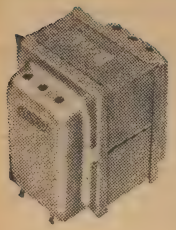

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PF 165	230-240	385	60	6.3V/2A 5V/2A
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PF 168	230-240	385	80	6.3V/2A 6.3V/2A 5V/2A
PF 169	230-240	325	80	6.3V/2A 6.3V/2A 5V/2A
PF 173	230-240	425	175	6.3VCT/3A 6.3V/2A 5V/2A
PF 174	230-240	285	150	6.3VCT/2A 6.3V/2A 5V/2A
PF 175	230-240	385	150	6.3VCT/2A 6.3V/2A 5V/2A
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OP 19A	15	5000 PP	12.5, 8, 2.3	30-15,000 C/S
OP 65	15	10,000 PP	8.4, 2.1	30-15,000 C/S
OP 67	15	5000 PP	15, 6.5	20-30,000 C/S
OP117	6	5000 PP	8, 2	40-12,000 C/S
OP119	6	6600 PP	2, 8	40-12,000 C/S
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equidistant between two rigid plates, these being acoustically transparent (i.e. they allow sound waves to pass through them unimpeded).

(3) The whole assembly is formed into an arc in the horizontal plane. (See Fig. 7.)

We will now examine the behavior of this push-pull loudspeaker. If we changes from a single-sided amplifier to a push-pull amplifier there are appreciable improvements in distortion and power output, but even one changes from a single-sided electrostatic loudspeaker to a balanced-push-pull type it would be an understatement to say that the improvements are appreciable: they are indeed spectacular, as can be shown mathematically and experimentally.[3]

WILL NOT MOVE

If, in the absence of a signal from the amplifier we switch the polarising voltage into circuit, the diaphragm will not move toward either plate, because it is subjected to equal and opposite electrostatic forces from each plate.

This means that the diaphragm need not be stretched to resist the electric forces, thus removing one cause of the non-linearities inherent in the single-sided loudspeaker previously discussed.

Another important feature of the push-pull assembly is this: if the diaphragm is moved toward one plate it does not upset the condition of equal and opposite forces acting on it, provided that the charge is maintained, and this can easily be ensured by making the resistance in series with the diaphragm of sufficient magnitude to give a long time-constant.

Under the above conditions the loudspeaker is an almost linear device, and harmonic distortion is extremely low. An unusual feature of this push-pull device is that the second harmonic will always be greater than any other; furthermore, it can be shown that if the second harmonic is reduced all the higher harmonics are reduced simultaneously!

1% PER CENT!

At volume levels sufficient for a small hall, the particular type of loudspeaker illustrated in Fig. 7 has a measured distortion content over the working range of approximately 1 pc! This result may be considered incredible, and it is therefore worth recalling that incredulity was also expressed when the author introduced the very low-distortion amplifier (the original "Point One") in 1945.[4] Strangely enough, there is often resistance to progressive developments, both in the arts and the sciences.

Fig. 8 shows that the frequency response of the loudspeaker in the horizontal plane is excellent, and the high frequency response is maintained off the axis because of the curved construction. However, in the vertical plane the response will be more directional if the total area of the diaphragm is used as the radiator for high frequencies.[5]

A broader directivity can be obtained by sub-dividing the diaphragm and/or fixed plates, and feeding these separate areas through electrical dividing networks connected to tappings on the transformer. A further advantage can be obtained from this expedient because it tends to minimise the variation of load impedance with frequency. [6] A neat solution of these directivity/impedance problems is offered by Janszen, who uses a diaphragm coated with resistive material.[7]

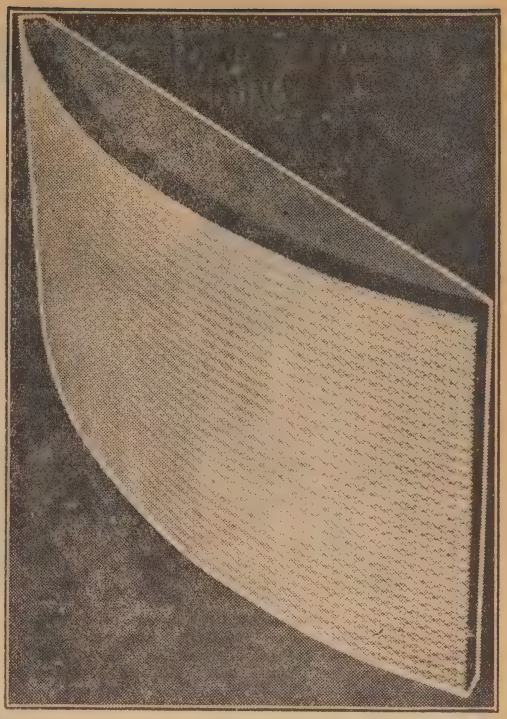

Fig. 7: A developed balanced push-pull electrostatic loudspeaker.

The absence of rapid changes in the frequency characteristic is indicative of a transient response superior to any other form of loudspeaker (excepting the Ionophone,[8] a gaseous device previously investigated by the author). Corrington confirms that a similar type of balanced-push-pull electrostatic loudspeaker gives transient decay measurements greatly superior to those of any other loudspeaker tested in the RCA acoustics laboraties.[2]

The acoustic output from this type of balanced-push-pull electrostatic loudspeaker is of the same order as from convential cone loudspeakers. Its sensitivity is therefore satisfactory, in direct contrast with the single-sided system.

From the above performance details the reader may deduce that in this particular case it is possible to disagree for the first time with the dictum that "the loudspeaker is the weakest link in the chain". Any record-pickup combination and any transmitter/receiver combination (FM included), will have greater distortions than this particular loudspeaker.

REVOLUTIONARY

This is, of course, a revolutionary engineering situation, but the reader may ask, "Does this loudspeaker sound revolutionary?" The short answer is, "It most certainly can do so, but much depends on the goodness of the bass woofer which must of necessity be heard simultaneously."

Now, there is little to choose between the better few of available conventional 15in woofers, and when the balanced-push-pull electrostatic tweeter of Fig. 7 is properly married to such a woofer the overall quality of reproduction is voted a notable advance by the majority of listeners.

A further noticeable improvement in sound quality can be effected by using novel constructions and materials for the woofer, and it has thereby been found possible to eradicate or ameliorate three significant distortions common to all the contemporary woofers investigated by the author. However, these developments make another story, and it must suffice to say here that a greatly improved tweeter needs and deserves a greatly improved woofer.

To sum up: the author believes that the development of balanced-push-pull electrostatic loudspeakers will rank in importance, as an advance in listening quality, with the advent of the Rice-Kellog moving-coil loudspeaker in 1925 and with the introduction of very low-distortion amplifiers in 1945.

REFERENCES

[1] British Standard 2498: 1954.
"Recommendations for Ascertaining and Expressing the Performance of Loudspeakers by Objective Measurements".
British Standards Institution, London, W.1.

[2] "Correlation of Transient Measurements on Loudspeakers with Listening Tests".
Murlan S. Corrington.
Presented at the Annual Convention of the Audio Engineering Society. October 16th, 1954.

[3] "Electroacoustics".
F. V. Hunt.
Harvard University Press, 1954.

[4] H. J. Leak & Co. Ltd. First "Point One" announcement. Journal Brit. I.R.E., October, 1945.

[5] "Acoustics". L. L. Beranek. McGraw-Hill Book Co. Inc, 1954

[6] D.E.L. Shorter. Brit. Pat. No. 537,931.

[7] A. A. Janszen. U.S. Pat. No. 2,631,196.

[8] S. Klein. "Un nouveau transducteur electroacoustique: l'ionophone". Proc. of First I.C.A. Congress: Electroacoustics. W. D. Meinema, Delft, 1953.

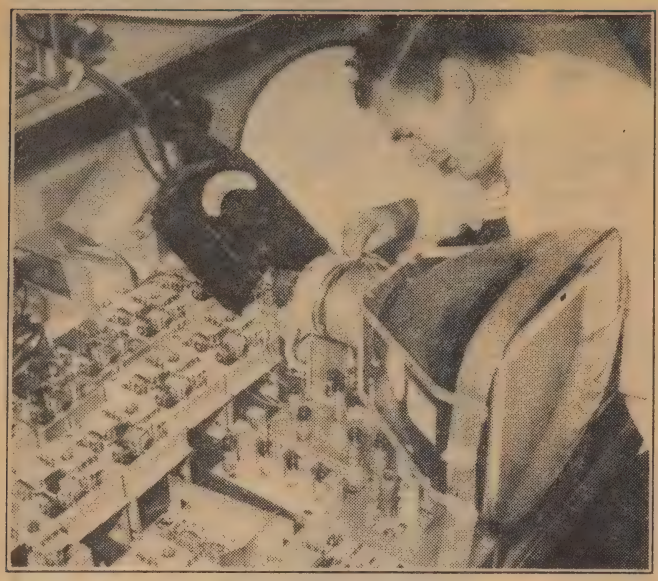

Figure 1: For some years engineers in the major Australian radio factories have been working quietly on prototype television receivers. Pilot runs have been put through to discover assembly problems and manufacturing costs. Very soon the rush will be on to produce, buy, instal—and service—the nation's TV receivers.

A COURSE IN TELEVISION

Within the next twelve months, television will have become a "hot" topic of conversation in Australia. By all present indications, receivers will be on sale and preliminary programs on the air. Servicemen will be wondering about the problems to come and readers speculating on the chances of building their own receiver. Our new course in television is designed to bring you up to date in this most important subject.

PART ONE

by W. N. Williams

IN framing the course, we have tried to anticipate the needs and the approach of the average reader of Radio, Television and Hobbies.

We visualise this "average" reader as someone who is reasonably familiar with ordinary radio terms, components and circuitry. At the very least he has built a few receivers and amplifiers but he probably isn't too happy with maths, graphs and formulas beyond secondary school standard.

HOW IT WORKS

Right now, he wants to know how a television set works and, better still, how to make it work again when something goes wrong.

In other words, our average reader is likely to be a radio serviceman, a dealer or technician, a "Ham" or someone for whom radio has been a long-standing hobby.

This being so, we are not going to concern ourselves with the basic elements of radio theory, nor are we going to the other extreme, to get bogged down in a mass of design data which really concerns a components engineer.

Our job is to explain the principles of television, insofar as they concern the "average" reader, to discuss and illustrate typical components and the kind of circuits in which they are used. If we can do this without the articles becoming too involved, we will have accomplished our aim.

Approached on this basis, the reader's main problem will not be to understand individual articles but to remember what has gone before.

We can only suggest that you f each issue, or, if you feel incline cut out the relevant pages and pas them in a large scrap book. Th way you will have your televisio course in one piece for handy cro reference.

Our course will start in the tel vision studio, with a glance at t picture to be televised and the mea whereby its light and shade a translated into electrical signa capable of being amplified a broadcast by a radio transmitter.

We shall follow the picture sign and its accompanying sound to t receiving aerial, thence through t various stages of the receiver to t point where the signals divide, o to operate the picture tube and t other the loudspeaker.

We shall examine the timing si nals which are necessary to kee transmitter and receivers in step, that viewers see a steady image not one that flickers and jumps lik the picture from a broken-dow movie projector!

We shall examine the special fe tures of a television receiver: I tuning system, its IF channel an valve complement, its picture contr circuits, its power supply arrange ments, its sound channel and so o But let's not make it sound too com plicated; these subjects are som months away.

Let's start in right at the begin ning.

Have a look at the picture on t foot of the next page. In its origin form, it was an ordinary Press re lease photograph, with plenty of de tail and contrast.

As it appears on the printed pag it might still be accepted as the pi ure of an attractive model, not unlik dozens of other pictures which ap pear every day in the newspapers

If you look closely into it, how ever, you will find that it isn't homogenous picture at all but pattern of tiny black dots.

In some parts of the picture, th dots are quite small and obscu very little of the white surface o which they are printed. To the ey these areas appear nearly white, o at most, a light grey.

DARKER TONES

Elsewhere the dots are muc larger, actually merging in som areas to obscure the paper surfac almost completely. To the eye, thes areas appear as tones of dark grey through to black. So the vary ing proportions of white to blac

as across the surface of the pic-
e produce the illusion of vary-
tones of grey, corresponding
those in the original photograph.
To illustrate the point more clearly,
had our blockmakers enlarge one
y section of the picture, to a
nt where the dots appear as a
y coarse pattern. In fact, those
miling Irish eyes" are revealed
a grotesque conglomeration of
ck and white spots.
Look at this enlargement close up,
n try again at arm's length.
ally prop the magazine up and
w the enlargement from a dist-
e of several feet. You will find
t the pattern of dots and spots
rges into a quite acceptable pic-
e of a young lady's left eye!
Blockmakers do not superimpose
dot pattern (a screen) on pic-
res for the fun of it, but
necessity. Only by "tak-
; the picture to pieces" and
senting it as pattern of tiny black
white areas, are they able suc-
sfully to reproduce a half-tone
otograph on a printed page.

INTING PROBLEMS

The optimum size and spacing of
dots is determined by the kind
paper on which the reproduction
ist appear, the kind of printing
ss, the kind of ink and the speed
printing. Illustrations printed on
wsprint on high-speed rotary
sses normally use a fairly coarse
een, which can be seen quite
dily if you look for it.
Magazines printed by different
sses on more expensive paper
ly use illustrations with a screen
fine that it defies detection with
naked eye. As a result, the illus-
tion looks more like an original
otograph and the detail is far
tter than is possible using a coarse
een.
But why have we said all this?
nply to emphasise certain basic
cts, as under:
1. The pictures we normally look
in papers and magazines are not
single entity but a composite of
y black and white areas. This
even true of original photographs
nich are built up from grains or
mps of metallic silver.
2. Our eyes will accept such a
mposite as a complete, unit pic-
re, provided the components are
all enough in relation to the pic-
re area, the viewing distance and
e detail which the eyes can re-
lve.

UE FOR TELEVISION

This last observation is just as
sic and important to television as
is to printing, because there is
known way at present of trans-
itting a picture electronically in
lk from one point to another.
Picture transmission relies entirely
the principle of "taking the pic-
re to pieces" and reassembling it
ece by piece at the far end. The
naller the pieces into which it can
divided, the better will be the
tail in the distant reproduction.
It would seemingly be ideal if
ery picture or scene to be televised
uld be divided into segments as
nall and as numerous as the dots
a printed picture; then, each of
e areas could conceivably be link-
to an equivalent area on a view-
ing screen, so that what looked
bright on the original would auto-
matically look bright to the viewer
and so on.
Unfortunately, such a scheme is
not practical because it would re-
quire a separate signal channel for
each dot or area in the picture —
and there are obviously tens of
thousands of them.
To avoid this requirement, the
only possible alternative is to
analyse the picture in a sequential
fashion, sector after sector. By
converting this information into
electrical signals, suitable for trans-
mission and reception, the scene
can be reconstructed at a remote
point, using only a single channel.
The usual process of picture
analysis is known as "scanning".

SCANNING PRINCIPLE

Let's say that we wanted to "scan"
the picture below for purposes of
transmission. We might set up
apparatus which would shine a small
but intense spot of light in the ex-
treme top left corner of the picture
We might arrange a collector lens,
facing the picture, to gather the light
reflected back from the surface of
the picture and focus it on to the
cathode of a photoelectric cell.
Since the upper left hand corner
of the picture is very dark, little
light would be reflected off it and
the photocell current would be quite
small.
New let's assume that the spot of
light is moved progressively to the
right. At a certain point in its travel,
it would encounter a somewhat
lighter area. The reflected light
would therefore increase and with it
the cell current.

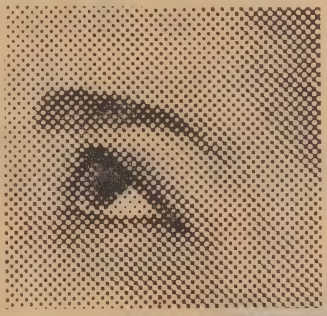

Figure 2.

The picture on the right is an ordinary magazine illustration composed, if you look closely, of a pattern of fine dots. A small sector is shown enlarged above.

Figure 3.

Just as the eye accepts this dot-pattern as a complete picture, so does it merge the lines in a television image.

Approaching the right hand cor-
ner of the picture, the moving light
spot would encounter a further
black area and the photocell cur-
rent would therefore revert to its
original low value.
In other words, the variation in
photocell current, as the light spot
travels from left to right, would
represent a signal proportional to the
light and shade of the image.
One movement across the image
constitutes a single scanning line.
On completion of the first scan-
ning line, along the extreme top edge
of the picture, the spot might well
be swung back to the left-hand side
to a point just underneath its original
position. It might then be moved
progressively to the right again, to
analyse a second narrow strip of the
picture immediately beneath the top
line.
So the analysis could continue,
line by line, till the whole surface
of the original picture has been ex-
amined.
Figures 4 and 5 illustrate in detail
the path which would be followed
by a light spot scanning a complete
picture. It is assumed to move
steadily from left to right to com-
plete each line, flicking back to the
left-hand edge to start the next line.

SIMPLE SCANNING

Because the lines follow one upon
the other in simple order, this type
of scanning is known as "simple",
"sequential" or "progressive" scan-
ning, the terms meaning the same
thing.
A familiar and elementary adap-
tation of this general principle is
seen in the equipment currently used
to transmit news pictures by tele-
phone or radio.
The original picture is wrapped
around a drum and slipped into posi-
tion in the "picturegram" machine.
For purposes of transmission, a
bright spot of light is made to travel
along one edge of the picture; a
photocell assembly responds to the
reflected light and generates a sig-
nal which varies according to the
light and shade of the image.
At the end of the line scan, the
light moves rapidly back to its start-
ing point, while the drum rotates
by just enough to place the next
scan alongside the one just com-
pleted. So the process continues
until the complete picture has been
scanned.
The signals generated by the photo-

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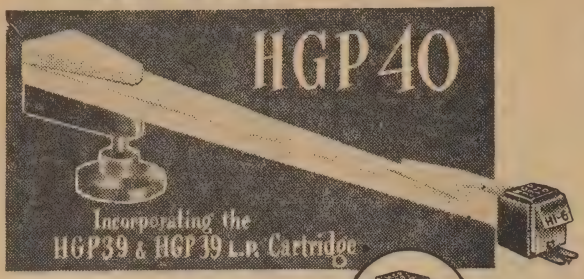

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PLUS **Multiplex Input!**

SOME EARLY MECHANICAL TV SCANNING SYSTEMS

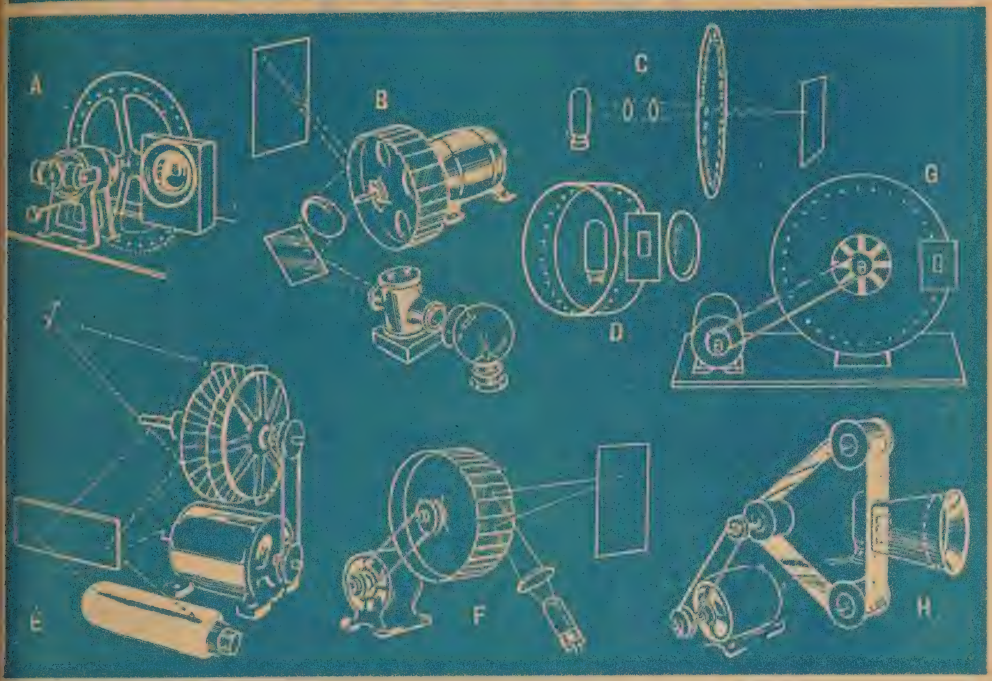

Figure 7: This block, reprinted from our earlier television course illustrates some of the early types of mechanical television scanning apparatus. (A) Receiver using Nipkow disc and lens. (B) Receiver using a drum scanner and a Kerr cell to modulate light from an ordinary globe. (C) Projection type disc scanner. (D) Similar to (A) but using a drum scanner. (E) Disc with inclined mirrors. (F) Mirror drum with mercury light source. (G) Nipkow disc with belt drive. (H) Belt type scanner.

ll are meanwhile amplified and ther fed directly into a telephone ie or used to modulate an ordin-y radio transmitter.

At the receiving end, the signals e fed to a second equipment, nich has been set up to operate a recorder. Here the signals are ed to vary the intensity of a light am shining on a piece of photo-nsitised paper.

OTORS SYNCHRONISED

The driving motor in the receiv-ig device is carefully synchronised th that at the transmitting end, that the to-and-fro movement of le scanning spots in both equip-ents is precisely the same.

Thus, the variations in cell output the beam scans the original pic-re, control the intensity of the ght which is focused at each in-ant on to an equivalent spot on e sensitised paper in the receiv-g equipment. After development, e image becomes visible.

By changing the phase of the re-oducing signal, it is possible to ake the receiver produce either a positive" print or a "negative" ansparency from which any num-r of photographic copies can be ade. Other methods of copying ave been devised, but these are not nportant in the present discussion, hich is primarily concerned with e principle of scanning.

Figure 7 (overleaf) is a sector of an early wirephoto, which has been grossly enlarged to emphasise the line structure. The reproduction, as you see it, also carries the dot structure necessary for printing purposes, so that little of the original definition is left. However, it should serve as an illustration of what we have been saying.

It so happens that the lines in this picture run vertically, but this is purely because it was loaded that way on to the drum. It does not alter the principle of what has already been said.

Modern picturegram equipment, operating under favorable conditions, can produce pictures at the receiving end with a line structure so fine that it is hard to detect with the unaided eye. The definition is far better than is necessary for ordinary newspaper reproduction. But we must pass on:

TELEVISION IS DIFFERENT

The transmission of a single picture by line or radio link is a leisurely operation, comparatively, because it generally does not matter if it takes several minutes to scan and reproduce the said picture. Television is a very different story.

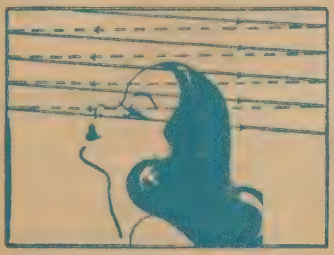

Figure 4: Illustrating how the scanning spot moves across the subject discovering light and dark areas.

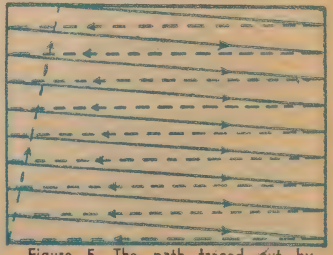

Figure 5. The path traced out by the scanning beam during one simple, progressive scan. Dotted lines are return traces.

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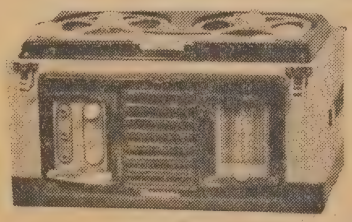

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VIC.: TOPLINE RECORING SERVICE
5 Buckley St., Noble Park—UM9402
W.A.: SURBURBAN RADIO CO.
334 Charles St., Nth. Perth—BA2395

n the first place, the reproduced
ge must be presented directly
he eyes of the viewer, so that
e is no room for any photo-
hic process to intervene. The
ge must be in the form of a
t pattern.
econdly, since "moving pictures"
r required of a television system,
ust be capable of presenting to
eyes of the viewer a rapid se-
nce of "still" pictures as happens,
example, in the cinema.

o meet these requirements, a
ety of mechanical gadgets were
ised for the early television sys-
s (1930 onward). Some of these
gets are illustrated on the pre-
is page. (Figure 7.)

KOW DISC

erhaps the best known was the
kow scanning disc, illustrated in
gram "A". The viewer looked
ugh a lens system on to a flat
trode in a neon-type glow lamp.
light surrounding this electrode
modulated by the incoming pic-
signal.

nterposed between the lens and
lamp was a disc, punched with
eries of holes having the same
ern and spinning at the same
ed as the scanning disc at the
nsmitting end. The holes were
placed that only one tiny sector
the original image or the glow-
lamp was exposed at the one
ant.

he diagram illustrates a vertical
nning action, as used in some
ly systems, but this need not
se any confusion.

igure 8, below, indicates the set-
at the transmitting end, where
subject's face is illuminated by
ght source shining through holes
the spinning disc.

t a particular instant, for ex-
ple, the scanning disc at the trans-
ting end might expose a high-
it in the original scene in the
left-hand corner. It would pro-
e a corresponding picture signal
cause the lamp at the receiving
to glow brightly.

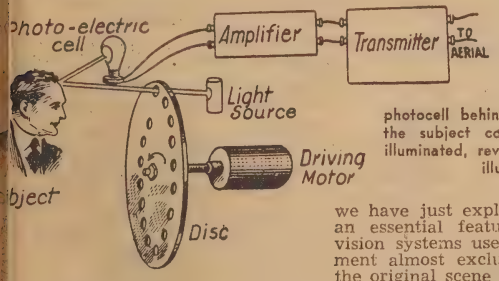

Figure 8: Illustrating the principle of a disc-type televisor. By placing the photocell behind the scanning disc, the subject could be permanently illuminated, reversing the conditions illustrated.

Assuming that the discs were pro-
rly synchronised, the viewer would
erefore see a bright spot of light
the corresponding position. The
ht value would normally vary,
wever, as the same hole in the
c sweeps along the edge of the
ginal scene and its reproduced
age.

As the first hole moves out of the
ld of vision, the second hole would
pear at the top, ready to com-
nce a scan exactly alongside the
e just completed. So the process
uld continue, line following line,
l the whole surface of the image
d been scanned.

Figure 6: This picture, received by an early type of picturegram equipment, has been enlarged to emphasise the line structure. It illustrates very clearly how an image can be built up, as it is in television, from a succession of lines placed one alongside the other.

At the completion of the picture scan, the first hole would be in the proper position to commence the first line of the next scan, and so the process would repeat itself, line following line and picture following picture in rapid sequence.

A variety of other gadgets were devised to give a similar scanning effect and some of these are illustrated in the accompanying diagram. The more elaborate ones used a system of inclined mirrors or even inclined lenses to direct a beam of modulated light on to a viewing screen in the appropriate scanning pattern.

In practice all such schemes are out-dated and there is no point in trying to study them in detail. Although the scanning principle, which we have just explained, remains as an essential feature, modern television systems use electronic equipment almost exclusively to analyse the original scene and reconstruct it at the receiving end.

One point should be very obvious, however, namely, the degree to which the television method of presentation depends on the property called persistence of vision. Just glance at a light or an open window, then close your eyes and note how the image takes quite an appreciable time to fade away.

Motion pictures, viewed in the theatre, are only possible by reason of this characteristic of the human eye. The projector throws a whole series of bright pictures on the screen, separated by brief periods of complete darkness. Each picture is a "still", representing progressive steps in the action being depicted.

Persistence of vision prevents the audience from noticing the blackout periods between pictures and also smooths out the tiny increments of action into what looks like smooth movement. Only on very rapid movements across the screen is any jumpiness noticeable.

Television presentation makes an even greater demand on the eye than this because it never does present a complete picture at a time. The eye to constitute complete pictures from the flying light spot and then build up from the pictures so retained the impression of smooth motion.

FLICKER EFFECTS

As might be expected, freedom from flicker and a smooth movement of the image are only obtained if the scanning process can be speeded up sufficiently to present to the viewer a certain minimum number of complete pictures per second.

Judged on the most elementary motion-picture equipment, this calls for at least 32 pictures per second—in other words at least 32 complete scans per second.

Additionally, of course, the picture can only have real entertainment value if it is bright enough, large enough and capable of showing a reasonable amount of detail.

In general, the mechanical systems illustrated in figure 7 failed to satisfy these requirements. Initially they gave only a very crude picture and attempts to improve definition, and picture size involved more bulky equipment and prohibitive rotational speeds for the scanning disc.

Hence the adoption, as already mentioned, of electronic methods of scanning and picture presentation. We shall not be able to proceed much further, then, without pausing to study the principles of the cathode ray tube.

(To be continued)

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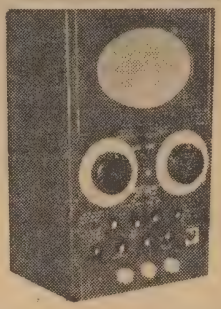
DAY LA3845 — NIGHT XW5956

A.C.E. Amplification Communication Electronics

DULWICH HILL, UNDERCLIFFE, EARLWOOD
EVENINGS and WEEKENDS: "KALUA"



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12 Valve. Converted to 240V A.C. Thoroughly Tested. Realigned. Latest Ovaltone Permag Speaker. Noise limiter added.

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NEW — RT34-APS13

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12 Valve, 420 Meg Transmitter Receiver Gene Powered 5-UJ6, 9-UAG5, 1VR150 2-2D2 Complete with Circuit and Conversion Circuit.

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LESS VALVES, £6/17/6

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1C6	12/6	12SJ7	12/6
1D4	12/6	12SK	12/6
1G4	12/6	12SL7	12/6
1J6	12/6	38	12/6
1K4	12/6	39/44	10/-
1K6	12/6	46	12/6
1LH4	12/6	47	12/6
1LN5	12/6	78	12/6
1P5	12/6	304H	£5
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2A6	12/6	828	£2/10/-
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6AC7	12/6	1625	£1
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AIR TESTED

Transmitter-Receiver, Aerial Coupler, Cables, Plugs, Phones, Mike. 1 Crystal to desired Frequency. 24V Power Supply & Circuits of 3 units GUARANTEED IN PERFECT ORDER.

£62/10/-

Other voltages available.

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EA50, 100UA Meter, Ceramic Switch. Metal Carrying Case Reads 100V and 500V from 75 Co-ax Line, but can readily be altered to suit individual requirements.

With Circuit, NEW **£3/17/6**

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VCR.138 .... £2/2/6
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Connections & Basic Circuit included

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½MILE DRUMS 15/-
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24 to 32V DC Input
230V AC 50 Cycles Output

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1.5 TO 12.5 MEGS.
4 Position Crystal on both units.
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Plate Modulated.
Receiver. Sensitivity 2MV
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20 Watt 6600 P to P to 600

£2/5/-

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12 volt DPDT 5 amp £1/-/-
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Tx. Var. Condensers. 300 pf £1/5/- 100 pf £1/1/-
60 pf with Vernier £1/1/-
30 pf 10/-

★★★★★★★★ RADIO

PHONE LA 3845

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Complete with valves and Circuit

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cludes Hand Generator, 2 Valves, Antennae, Key, etc.
Ts type used extensively during recent ods. Converts to other frequencies.

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5 x 325 125 12V. £2/17/6

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240 V. 40 watt £2/17/6
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SMALL FULLY-SHIELDED 2500V. £1/17/6.
SELENIUM RECTIFIERS.
00V. 10MA. £2/7/6

UBULAR CONDENSERS

5, .1, .02, .008 .. 600v 9/- doz.
, .25, .1 .. .. .. 400v 7/6 doz.
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ew Coils & Intermediates andard or miniature to suit all valves.

oils B/C 455 KC 7/6
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2 Genemotors, 550V 350MA & 250V 100MA, Chokes, Condensers, etc.

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ALL TESTED

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Communication Receivers, Test equipment, P. A. gear. Large or small surplus stock. Best prices. Call, write or phone any time.

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4UF 1KV .. 12/6	8UF 400V .. 10/-
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Receivers. 6 valve. Converts to Carset or Q5ER, 6R7, 6SA7, 6SK7; 6SQ7, 22SL6

£5/17/6

INCLUDING CIRCUIT

BUZZERS

HIGH PITCH, VARIABLE NOTE
Including built-in Transformer.

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OSTER MOTORS

NEW & TESTED.
THE MODELLER'S DELIGHT.

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12v 500 WATT
TESTED — GOOD ORDER

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522 GENEMOTORS

300V 250V plus 150V +12V fils. 8 Amp, 24V Input. FULLY FILTERED.

20/-

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Australia's finest communications receiver. Built by STC. 10 valves, crystal gate, noise limiter, Bandspread coverage 1.5 to 24 megs continuous. 240 volts AC operation. Air tested. Sensitivity better than 2 microvolts.

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Specially Realigned Calibrated and Crystal Phased.

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NEW CONDITION

13 Valve FM Transceiver operating on 480 Meg Band.

Genemotor Powered 28V — 3-OSH7, 3-12SJ7, 2-12H6, 1VR150, 2-955, 2-9004.

£6/17/6

NEW V.H.F. WAVEMETERS

3 Valves, 0-1 M. A. Meter
Slow-motion dial.

INCLUDING CIRCUIT **£5/17/6**

160-220 M.C.S. readily convert to 144 M.C.S.

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Operates Panel Lamp for Nursery Sickroom, etc.
6d. per month for power.

5/- ea.

GENEMOTORS

Input	Output			
24V	250V 100MA	£1	0	0
24V	550V 375MA	2	0	0
24V	300V 250MA	1	0	0
24V	250V 60MA	1	5	0
12V	270V 100MA	3	15	0
12V	500V 350 MA	8	10	0
12V	1200V 200MA	6	10	0
6V	500V 150MA	6	10	0

THE COLOR CODING OF RESISTORS

Most resistors in use in Australia are color coded according to the system adopted by the Radio Manufacturers Association (USA). At the request of many readers, the basis of this code is explained below.

SEPARATE colors are used to represent the numerals 0-9, and the color or combinations are used to express the resistance value directly in ohms. The colors have the following significance: black 0, brown 1, red 2, orange 3, yellow 4, green 5, blue 6, violet 7, grey 8, white 9.

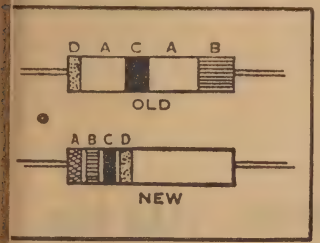
In the older system the first figure of the resistance value is represented by the body color (A). Thus if the main body of the resistor is red it follows that the first figure in the resistor value must be "2".

The second figure in the resistance value is shown by the end color (B). The significance of the individual color remains unaltered in that, if our previously mentioned red resistor has a green end, the first two significant figures would be "25".

COLOR DOT OR BAND

The color dot or band at the centre of the resistor (C) shows the number of noughts which have to be added after the first two significant figures.

A black dot would indicate no noughts and therefore the resistance value would be merely 25 ohms. With a brown dot, the resistance



value would be 2-5-0 or 250 ohms. In the case of a 2500 ohm resistor, the dot would obviously have to be red, and so would not be apparent on the red body. Hence, if no dot is apparent, it can be assumed that the color of the dot is the same as that of the body.

By way of example, one may encounter a red resistor with a black end. Referring back to the list, the first two significant figures must be "20". The dot must be assumed to be of the same color as the body ... red. This signifies two noughts, so that the value becomes 2-0-00, equals 2000 ohms.

ANOTHER EXAMPLE

To take another popular example, a green resistor with black end and yellow dot or band is 5-0-0000 equals 500,000 ohms or 0.5 megohm.

It will be apparent that the coding system does not lend itself to resistance values requiring more than two significant figures ahead of the noughts.

The accompanying table sets out the colors and figures in a form which simplifies the transfer from color code to resistance value and vice versa. The second table shows the color codes directly for a selection of the most commonly encountered resistors in the "preferred values" range.

To simplify production the older marking system has now been replaced by a new system which presents the colors in a somewhat different manner.

Instead of being applied to body, end, and band, the significant colors are applied as three parallel bands around the resistor and toward one end. The body color of the resistor has no significance whatever.

SAME SIGNIFICANCE

Hold the resistor so that the color bands are toward the left and read off the colors from the left to right. The colors have the same significance as before, so that no difficulty should be encountered on this score.

Assuming that the color bands on a resistor were, left to right, red, green and yellow, the resistance value would be 2-5-0000, or 250,000 ohms. Occasionally a fourth band is added, on the right, of either silver or gold. A silver band signifies that the resistance value is within 10 pc of the marked value, while a gold band indicates a 5 pc tolerance.

The use of color bands instead of body, end and dot colors should occasion no confusion, provided you remember to hold the resistor with the bands toward the left and read off the colors from left to right.

RESISTOR COLOR CODE

Table showing popular preferred values of resistors in the R.M.A. color code.

Resistance in ohms	A	B	C
2200	Red	Red	Red
3300	Orange	Orange	Red
4700	Yellow	Violet	Red
6800	Blue	Grey	Red
10,000	Brown	Black	Orange
15,000	Brown	Green	Orange
22,000	Red	Red	Orange
33,000	Orange	Orange	Orange
47,000	Yellow	Violet	Orange
68,000	Blue	Grey	Orange
100,000	Brown	Black	Yellow
150,000	Brown	Green	Yellow
220,000	Red	Red	Yellow
330,000	Orange	Orange	Yellow
470,000	Yellow	Violet	Yellow
680,000	Blue	Grey	Yellow
1 Megohm	Brown	Black	Green
1.5 Megohm	Brown	Green	Green
2.2 Megohm	Red	Red	Green
3.3 Megohm	Orange	Orange	Green
4.7 Megohm	Yellow	Violet	Green
6.8 Megohm	Blue	Grey	Green
10 Megohm	Brown	Black	Blue

R.M.A. RESISTOR COLOR CODE—Values in ohms

Body Color	First Digit	End Color	Second Digit	Dot Color	Remaining Digit
Black	0	Black	0	Black	—
Brown	1	Brown	1	Brown	0
Red	2	Red	2	Red	00
Orange	3	Orange	3	Orange	000
Yellow	4	Yellow	4	Yellow	0000
Green	5	Green	5	Green	00,000
Blue	6	Blue	6	Blue	000,000
Violet	7	Violet	7	Violet	0,000,000
Grey	8	Grey	8	Grey	00,000,000
White	9	White	9	White	000,000,000

RESISTOR WATTAGE RATINGS

DEPENDING on their size and construction, resistors are able to dissipate a certain amount of heat without physical damage or undue changes in their electrical resistance.

The wattage involved can be calculated by squaring the voltage figure across a given resistor and dividing the result by the resistance in ohms.

Alternatively, the current in milliamps through the resistor can be squared, multiplied by the resistance in ohms and divided by 1-million.

As a general rule it is not advisable to operate resistors in confined spaces at more than about half their rated maximum dissipation. In cases of doubt, greater reliability can be expected if a larger resistor can be installed.

Where the dissipation approaches or exceeds 1-watt, the limit for standard carbon resistors, two such resistors can be used in parallel, each double the resistance value required. Thus two 50,000-ohm 1-watt resistors in parallel give an effective value of 25,000 ohms at 2 watts.

COLLINS RADIO

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SMITH ENGLISH SUPER CLOCK

MAX. DIA. 5⅞in. DEPTH 3½in.
FACE 4in. DIA. OF PLASTIC

- Sweep second hand.
- Luminous time hands.
- Internal time switch.
- Can be used in a clock radio.
- Can be used to control electric apparatus—jugs —pumps—heaters, etc.
- Switches on 10 minutes before internal alarm sounds.
- Switches off 1 hour after.
- Control to permit radio or apparatus to work for up to 60 minutes after setting (bedside radio).
- Only for engineers or serious experimeners. Applications are numberless.
- Self starting—precision made. 220-250volt—50 cycle.

Price £5/19/6

Plus 4/- Postage.

Full Scale

Expanded Aluminium

Suitable for speaker grilles, etc., can be used natural, or sprayed any color.

18 x 27in	40/-
13½ x 27in	30/-
13½ x 13½in	15/-
13½ x other inches	1/6 per inch

PACK AND POST 2/-.

ALUMINIUM CHASSIS

Spot Welded Ends

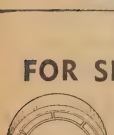
ALL POST FREE.

6 x 4 x 2	4A13	7/6
8 x 5 x 2½	4A14	10/-
10 x 6 x 2½	4A15	12/-
11 x 8 x 2	4A16	14/-
13 x 7 x 2½	4A17	14/-
13 x 10 x 2½	4A18	17/6
17 x 8 x 3	4A19	22/6
17 x 10 x 3	4A19	25/6
17 x 12 x 3	4A21	26/6

First grade aluminium, carefully turned corners, easy to drill or punch. Special sizes, 50 pc more.

BAKELITE BOXES

FOR SPEAKERS, CLOCKS, ETC.



No. 1 Round. 8in x 2 3-8in with 5in dia. opening. Takes 6in speaker.

Use two to make self-enclosed movable remote speaker.

Black to walnut.

6/- EACH, POST FREE

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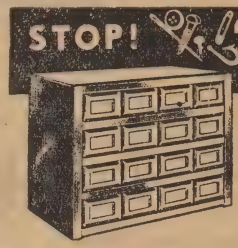
FIRST GRADE IRONCORE POWER-TRANSFORMERS. FLAT MOUNTING. 2 7/8 x 3½ x 1in core. Primary 220 and 240v 50 cycle A.C. Secondaries 200-0-200v 40 MA and 6.3v 2A. NORMAL PRICE 43/-.
OUR PRICE (add 4/4 postage) **25/-**



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1½in x 2⅝in x 5½in
or 4 Long Drawers
1½in x 10½in x 5½i
In THIS ALL-STEEL
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HANDY CABINET

A craftsman-built unit attractively painted in baked gre hammertone enamel with provision for fitting identification card on each drawer.

For any other type or sizes, use our FAST QUOTE SERVICE A strong and most useful cabinet for holding small parts o tools. Ideal for mechanic, engineer, garage or home work shop. Provision is made for stacking into units. **48/**
OVERALL SIZE 11½in. wide, 9in high, 5½in deep.
Postage: Vic., 3/8; NSW, ACT, SA, Tas., 6/-; Qld., WA., NT., 8/

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65	3/9	RADIO DESIGNS MANUAL
78	3/9	RADIO & TELEVISION LABORATORY MANUA
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102	4/6	40 CIRCUITS USING GERMANIUM DIODES
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126	3/9	THE BOYS' BOOK OF CRYSTAL SETS AN SIMPLE CIRCUITS
127	5/3	WIRELESS AMPLIFIER MANUAL No. 3
128	5/3	PRACTICAL TRANSISTORS AND TRANSISTO CIRCUITS
112	3/9	"RADIOFOLDER" C: AN ELECTRONIC MULTIMETER

PORTABLE 'GRAM CASES

Suitable for motor, pick up and amplifier (but n speaker). Strongly made of steel wih blac crinkle finish and hinged recessed lid. Size 20i x 12½in, height 8in. Lid including recess 4½i high. Space under lip for motor board 4¾in. **75/**
Part No. 4A5. Freight forward .. ..

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USE OUR FAST QUOTE SERVICE FOR PRICES OF PART YOU NEED FOR

JUNE ISSUE
2 Stage Transistor Set (p. 32)
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A.C. Grid Dip Osc. .. (p. 60)

JULY ISSUE
2 Band S/Wave Converter (p. 48)
3 Stage Transistor Set (p. 80)
Clock Radio .. .. (p. 64)

AUGUST ISSUE
Crystal •P.U. Amplifier (p. 1
Class B Transistor Set (p. 6
Grid Dip Meter .. .. (p. 8

SEPTEMBER ISSUE
High Powered Playmaster (p. 2
Audio Signal Generator (p. 4
1955 Radiogram (p. 5

We supply the parts, but cannot enter into any technical correspondence.

FAST QUOTE SERVICE

For quickest possible service, write on the left-hand side of a sheet of paper the radio parts that interest you — one beneath the other. If a kit, itemise. Add your name and address and send it to us with a stamped, self-addressed envelope. We will add the latest prices and return to you. Use this sheet as your order form and return to us with remittance for cost and postage as quoted. Goods will be sent same day. Any surplus refunded. Sorry, no C.O.D.

EVERYTHING FOR THE RADIO AND ELECTRICAL EXPERIMENTER

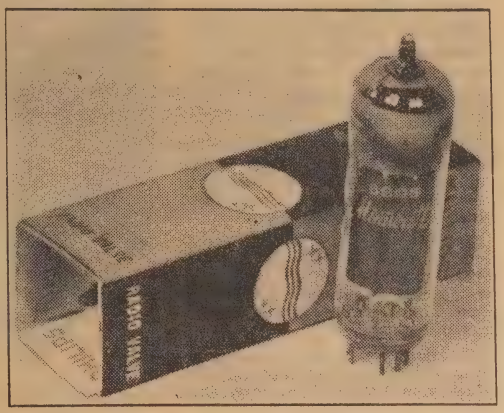
TRADE NOTES AND NEWS

EL84 NOW KNOWN AS 6BQ5

☆

6BQ5 medium power output valve. It has been known to date as the EL84.

☆



THE high slope EL84 output valve which has recently made its appearance in Australia seems likely to become the standard medium power output valve.

Its characteristics make it suitable, under a wide variety of plate voltages, for most purposes, including both standard radio receivers and higher powered output stages and amplifiers.

Philips have advised that in future they will sell this valve in Australia under its RTMA type number of 6BQ5.

There will be no alteration in the valve characteristics as a result of this change.

NEW GERMAN MICROPHONES

Among the items exhibited by R. H. Cunningham Pty Ltd. at the recent IRE Convention in Melbourne, was a range of acoustical microphones made by Laboratorium Wennebostal of Germany. These microphones have unique placement of the dynamic moving coil unit. Normally, this as at the top of the microphone and therefore vulnerable to shock and weather conditions.

IN the case of the L.W. microphones, with the moving coil unit located in the base, the microphone is rendered virtually unmageable and is waterproof.

The sound is conducted to the unit a slender alloy tube, built in uch a way as to be acoustically alanced from the mouthpiece to the ynamic unit chamber. The result a very high quality microphone, hile unobtrusive in appearance, and ossessing a light weight base (in e case of the floor models, approxiately 3½lb), which is virtually imossible to tip over when worked nder normal circumstances.

In the case of the desk model, the nit housing is not very much bigger than a billiard ball, and the ound column tubing being so slender in dimensions, would pass practically unnoticed in front of a peaker or lecturer.

Three models were exhibited at e Convention.

The Model MD3, which is a stand pe with a straight tubular colmn, has a frequency range of 30-0,000 cycles, with an output imedance of 200 ohms.

The MO3T desk microphone.

BOOK REVIEW

"SIMPLE Electronic Musical Instruments For The Constructor" by Alan Douglas. 72 pages, stiff paper cover.

Interest in electronic musical instruments is very high at the moment and readers wanting to know something about the subject without too much outlay will welcome this book by Alan Douglas.

The approach is essentially practical and, after a brief theoretical introduction, the author sets out to describe the construction of several of the simpler types of musical instrument. These include a couple of monophonic keyboard instruments, an electric accordeon, electric guitar and a pedal attachment for pianos or reed organs.

A separate chapter is devoted to percussion, attack and delay circuits. There are plenty of circuits and illustrations to study.

Our copy of the book came from the Electronic Organ Company (Aust.), 9-11 Cadow St., Pymble, NSW. Price quoted is 7/6.

From the same company comes another small book "Transistors and Crystal Diodes" by B. R. Bettridge of the Osram—G.E. Company, London. Price of this 72-page book is also quoted as 7/6.

It should be a helpful little book for anyone wishing to supplement the information already published in this magazine.

BRAMCO OFFERS AUDIO SPECIALS

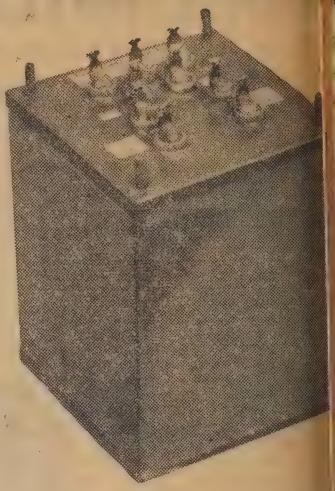
In order to cater for many cases where special audio components are needed, Bramco Radio Components, of Wallsend, are prepared to design and supply, with particular reference to transformers and chokes. In addition, a number of standard lines will be available.

IN the audio field, particularly since the rapid growth of wide range amplifying equipment, a circuit designers needs are not always obtainable "off the shelf".

Many of the larger transformer manufacturers at times have difficulty in handling orders which call for unusual windings, particularly when they are busy with long runs of stock items.

Realising this, Bramco are specialising in looking after such requirements, and are able to give each order individual attention.

This special order department is also able to supply accurate inductances for cross-over networks as used in loud speaker connections and various types of high and low pass filters. These are normally wound on strong, wooden bobbins with a single mounting bolt, and will be impregnated if required.



A 10-watt Bramco transformer wound for 6V6 valves with 5 per cent ultra-linear tappings.

Bramco Radio Components may be contacted at 83 Nelson St., Wallsend, Phone LL921.

ACOS RELEASE CERAMIC UNIT

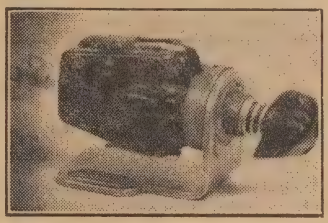
The popularity of the crystal type pick-up cartridge is sufficient evidence of its dependability under average conditions of temperature and humidity. But in tropical areas failures are not uncommon under conditions where many other things suffer rapid deterioration.

FOR some little time, pick-up cartridge manufacturers have been experimenting with a new type of cartridge with a barium titinate element in place of the Rochelle salt used in crystals.

These "ceramic" pick-ups are not susceptible to heat changes considerably beyond the atmosphere range, and are virtually impervious to moisture.

The main difficulties have been to obtain sufficient output together with satisfactory mechanical compliance in manufacture.

The new Acos ceramic cartridge will therefore be greeted with considerable interest as one of the first practical models yet manufactured, and the first to be seen in this country.



The Acos ceramic cartridge

TO REPLACE HGP37

It will not replace the crystal pick-up in general use, but is recommended in its stead for areas where crystals have shown a high percentage of failure.

Its output is slightly below that of the HGP37 which is its nearest equivalent, but the makers claim it is near enough to be considered a direct replacement.

Its own type number is GP61.

The turn-over head has two independent styli for standard and LP work. Each is replaceable at a cost of about 12/-, and is fitted with a sapphire tip.

A feature of the head is a lock for both playing positions as well as the mid or "half-turn" position in which the head is left when not in use.

A protrusion on the bakelite housing forms a rest for this mid-position.

The head is complete with a metal bracket punched with standard slotted holes and will therefore fit many popular arms.

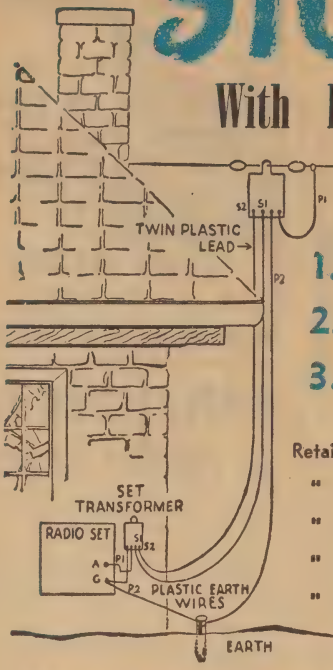
Its price is £3/19/6, which is somewhat dearer than the crystal type. Initial shipments will be mainly for tropical areas where the head is most valuable, but eventually it will be universally obtainable.

INTERFERENCE SUPPRESSOR FOR TV

This suppressor unit, manufactured by Belling-Lee of England, is intended for insertion in the power leads of domestic equipment to filter out possible electrical interference with TV programs. It is one of many TV components handled by R. H. Cunningham, of Melbourne. They are available thruogh various radio trade houses although the sample photographed above came from Messrs. Lawrence & Hanson Electrical Pty. Ltd., of 33 York Street, Sydney.

STOP NOISE IN YOUR SET

With R.C.S. aerial and line filters

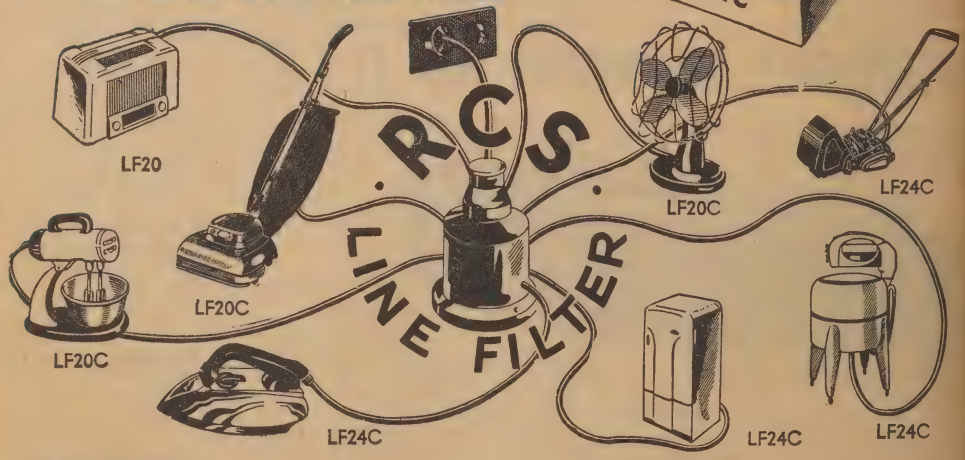


MAKE THIS SIMPLE TEST:—

1. Remove aerial from set. If the noise stops, you need an AF21C aerial filter, as the noise is coming through your aerial.
2. If the noise continues, you need an LF20 line filter as the noise is coming through your power main.
3. If any of the appliances shown below are causing the noise, then fit to it a line filter of the type shown.

Retail AF21C aerial filter		140/-
"	LF20 line filter ..	37/-
"	LF20C " "...	42/-
"	LF24 " "...	50/-
"	LF24C " "...	55/-

CONFINE NOISE WHERE IT STARTS — WITH R.C.S. LINE FILTER



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N.S.W. Bloch & Gerber—Fox & MacGillycuddy—U.A.D.—John Martin — Lawrence & Hansom — Homecrafts — Martin de Launay — Radio Despatch — Cooke Bros. —
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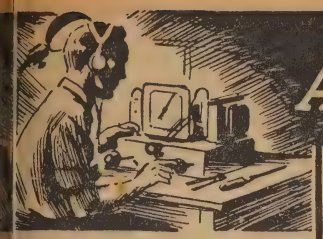
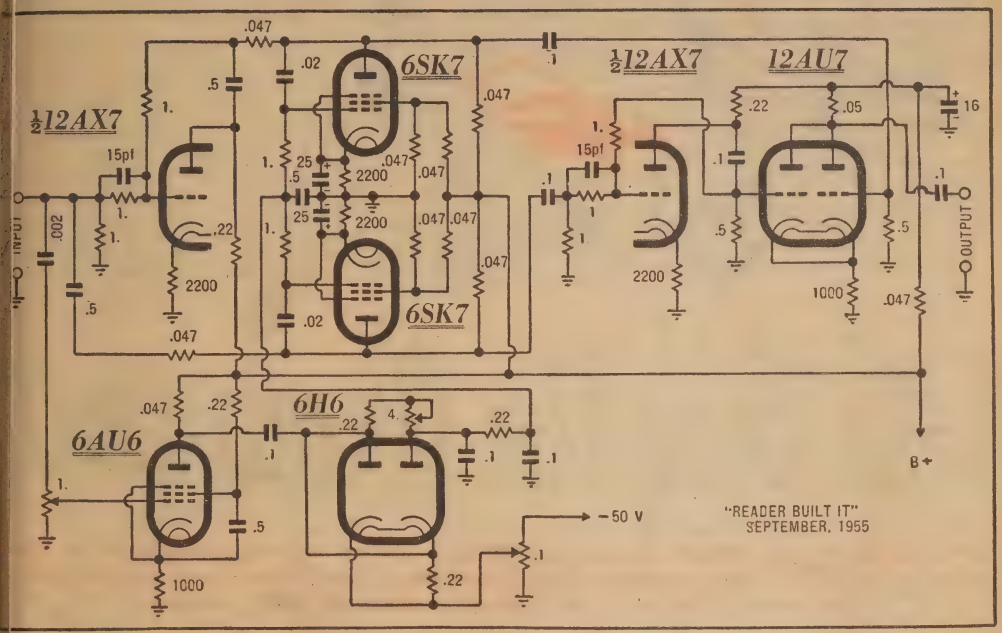
R. C. S. RADIO PTY. LTD. 651 FOREST ROAD, BEXLEY. PHONE LW 3491



A READER BUILT IT!

Gadgets and circuits which we have not actually tried out, but published for the general interest of beginners and experimenters.

RCUIT DETAILS OF HIGH QUALITY VOLUME EXPANDER



his month we publish a circuit of a volume expander unit submitted y Mr. C. Hart, 12 Waverley Street, South Perth, W.A. He claims at this unit improves the poor LP's and gives greatly improved results from the normal 78's.

JR reader designed this unit to meet his own particular require-nts. These were:—single-ended t and output, push-pull control e, no inductors and versatile trols.

he basic part of the expander is PP 6SK7 control stage, using the l-known reactance tube shunt hod of gain control. By varying bias on the tubes they can be le to have a greater or less edance in the bottom limb of a age divider.

n this circuit the 47K resistors ween the coupling capacitors and 6SK7 anodes form the top limbs, le the 6SK7's can be made to e an apparent impedance of be-en about 1000 ohms and .5 meg he bottom limbs.

lowever the complete range of trol that this divider would allow not be used since, on account other shunt impedances, the con-t characteristic is not linear near upper limit. But since about half of this range is sufficient for volume expansion, the linearity is excellent in practice.

The varying control bias for the 6SK7 grids is obtained from the 6H6 rectifier, which is fed by the 6AU6 "side-chain" amplifier. This is arranged so that the shunt reactance is highest when the signal is strongest, thus giving expansion.

PUSH-PULL CONTROL

The circuit combines PP operation of the control stage with single-ended input and output. To achieve this, one half of a 12AX7 is used as an anode-follower phase-inverter before the 6SK7's, one of the control tubes being fed from the inverter and the other direct from the input.

The other half of the 12AX7 is then used to invert again one of the out-of-phase output voltages. The resulting in phase voltages are then mixed in the 12AU7 summing stage. The 12AX7 inverters are in opposite sides of the PP signal so that each audio line has the same time constants applied to it, to make the final output voltages as similar as possible before mixing.

The changing from SE to PP and back to SE is used to eliminate "thump" on transients and to reduce distortion. The "thump" voltages are in phase in the PP stage, and so are out of phase in the mixer, where they cancel out.

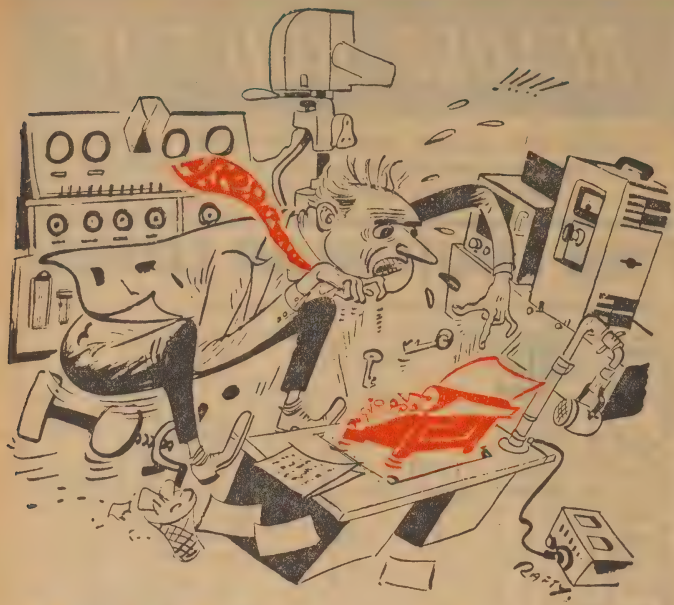
No instability is experienced from using the 12AX7 inverters in these positions, since the 6SK7's contribute no gain and do not change the phase of the signal.

If the gain of the unit is too high, it could be reduced by using the 12AU7 as a cathode-follower mixer by shifting the load to cathodes and taking the output from there.

The circuit is best operated at a fairly high level, e.g. between the tone control stage and the main amplifier.

The "attack" time of the circuit is fast, and the decay time can be varied by the 4meg potentiometer, from a fraction of a second, to about a second, being longest when this resistance is highest.

(Continued on Page 127)



Let's Buy An Argument

Continuing last month's theme about circuit design, I have to hand an interesting letter from a reader in Hay, NSW, who re-awakens the old question of signal-to-noise ratio and the use of low-noise "front-ends" for broadcast receivers in country districts.

by Neville Williams

IT is one of those subjects, which somebody unearths every now and again. Receiver design engineers say "Oh . . . er . . . yes . . ." and then go on to talk about something else. They seem quite contented with their conventional circuitry and quite unconvinced by arguments to the contrary.

The reason for this apparent lack of concern is very simple, in that the inherent signal-to-noise ratio of a receiver is not a problem to the vast majority of present-day set-owners. Why worry about it, then?

LOCAL STATIONS

Most radio listeners live in the cities, anyway, and their sets are seldom tuned to any but the local stations. Interest in other stations is rather fleeting and nobody loses much sleep if they can't be heard properly.

Then another goodly section of the populace lives in areas cursed by power line leaks and other forms of man-made interference. This blankets the weaker stations so effectively that the noise characteristic of the set itself doesn't need to be anything out of the ordinary.

Just how far this line of thinking has been pursued is illustrated by a statement which I heard some time ago from a prominent receiver design engineer. Cutting right across preconceived notions, he suggested that RF stages were largely redundant in modern domestic receivers:

(a) Because people only want local stations;

(b) Because man-made interference blankets weak stations anyway;

(c) Because modern circuits, valves, and aerial coils in particular, provide the same order of performance as was once available from older sets using an RF stage.

I might say that this claim caused a few raised eyebrows among the audience, but there it was.

Our friend from Hay, whom I shall henceforth refer to as T. takes up the cudgel on behalf of those who can allegedly benefit by improved signal-to-noise ratio in the receiver.

He says that his nearest station is 2QN, 80 miles away. Then follows 2RG, 100 miles away, 2WG at 180 miles and 2CO at 200 miles. There are plenty of more remote places of course, but his problem is bad enough.

RF GAIN

T.S. writes with the air of someone who has been fiddling with radio for a good while. He takes it for granted that an RF stage is essential for good results, but he goes farther.

Having explained that "noise" in receivers is a problem out here, he goes on to say that he has tried twin-triodes in place of the conventional RF and converter valves, and in each case, there was a notable improvement in signal-to-noise ratio. Why don't receiver designers wake up to themselves?

Figure 1 shows the RF amplifier stage, which T.S. substituted for the original pentode in his tuner. It gave about the same gain, judged on an S-meter, but was less noisy than the pentode.

His next step was to restore the pentode RF amplifier and wire the same twin-triode in place of the original converter, a 6J8-GA. This gave an even more marked improvement than replacing the RF stage and that is the way the tuner is wired at present.

FIRST IF STAGE

His circuit is reproduced in figure 1 and T.S. says that he is just waiting for enough time to reinstal the twin-triode RF stage and possibly substitute a similar stage in the first IF amplifier for good measure. Then he'll really have the noise problem licked!

He points out that a noise limiting detector is built in permanently because elimination of periodic static crashes is far more important than an occasional bit of distortion on modulation peaks.

The extra selectivity afforded by two IF stages is well worth having and the built-in line filter is a worthwhile refinement.

In short, his recipe for a countryman's radio tuner adds up to this: Twin-triode RF amplifier, twin-triode frequency changer, twin-

READER'S 'RECIPE' FOR COUNTRYMAN'S RADIO TUNER

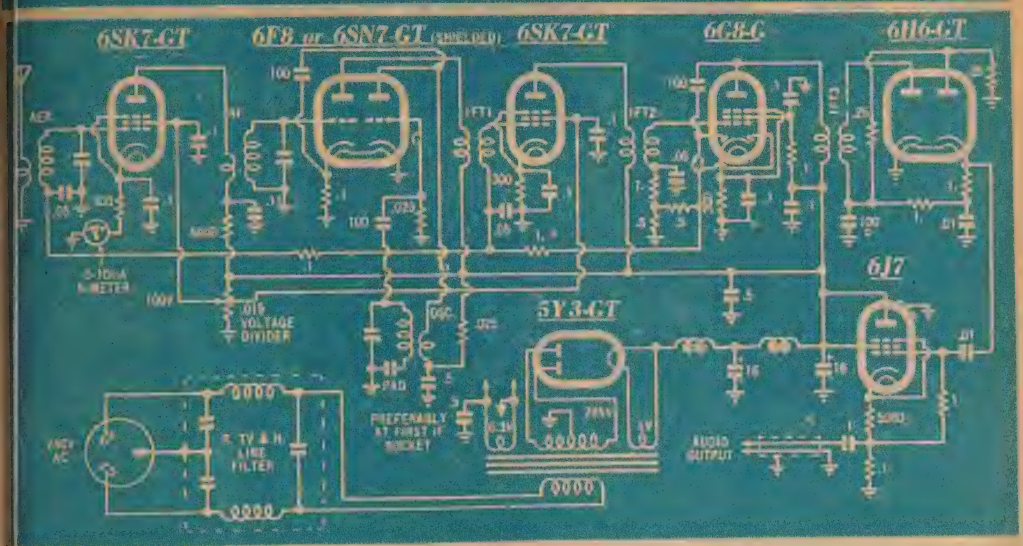


Figure 1: A reader from Hay, NSW, suggests that this tuner can give a much better signal-to-noise ratio than one using a conventional converter valve. A further improvement, he suggests, would be to add the twin-triode RF stage shown below.

de 1st IF amplifier, pentode 2nd. amplifier noise-limiting detector, (possibly) a cathode-follower ut valve to the main amplifier. uch a tuner could have no pre- ce to high fidelity. His problem, wever, is not to catch the last p of modulation, but to get any dulation at all! High fidelity lis- ing has to come from his own re- d playing equipment.

What do I think about all this? nkly, I take T.S.'s remarks with proverbial "grain of salt", not ause I question his observations, rather the grounds on which y are made.

RIAL COIL

t would be necessary, for ex- ple, to be quite certain that the rial coil was an efficient, high- n type, representative of the best dern practice. The point behind is is that the merit of the aerial l determines the input voltage to first grid—signal, interference, nospheric noise, and circuit noise, in.

If the aerial coil is poor, then the ss input to the first grid will be w and the noise content of the llowing circuits more significant as result.

Increase the aerial coil gain by y five times and the noise prob- n in the rest of the set diminishes the same factor. Such a mar- n might be decisive in determin- g whether or not a given type RF stage is worth while.

Then the RF coil comes into the ture because, in association with valve, it determines the RF stage in. If the RF stage gain is low, en the noise of the converter stage y be significant; if the RF stage in is high, then the reverse will st likely be true.

How do our correspondent's observations line up with these remarks?

In the first place, he records some improvement in signal-to-noise ratio when substituting a cathode-coupled twin-triode for the conventional pentode RF amplifier.

One might accept this, but only with reservations. Pentodes are usually credited with being very efficient amplifiers at broadcast frequencies, their noise contribution being completely swamped by external noise fed to them via an efficient aerial and coupling coil.

However, this is the point which T.S. is querying, rightly or wrongly.

Really speaking, the strangest thing about our correspondent's report is that changing the converter valve made an even greater difference than changing the RF amplifier. This doesn't add up at all.

According to the "Radiotron Designer's Handbook", a single pentode RF stage, providing a gain of from 10 to 15 times, is sufficient to override the noise of a converter, at least for all practical purposes.

It carries a vague implication that there might be better kinds of RF amplifier, but it is too vague to admit as evidence in the argument.

Very clearly, however, the pentode stage shown in T.S.'s circuit is not over-riding his converter noise. Surely it can only mean that his RF gain is a lot lower than it should be or that the converter is far noisier than it should be, to the point of incorrect operation.

It just doesn't sound convincing.

Still, I could be wrong.

One might expect a well-designed all-triode front end to give a somewhat better measured noise figure than a conventional circuit, but the difference should not be sensational. When connected to a large outdoor aerial, one might expect it to be even less apparent.

Auto sets might conceivably be in

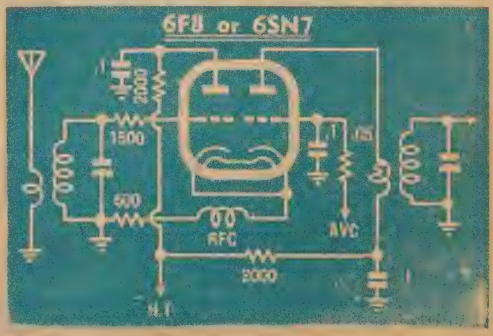


Figure 2: A cathode-coupled twin-triode which our correspondent suggests would give equivalent gain with much lower noise, if substituted for a conventional pentode RF amplifier. He suggests that such a stage could even be used to advantage in the role of first IF amplifier in the above circuit.

different class because they are quently called upon to work over g distances with comparatively rt aerials. In an electrically iet" car, it is just possible that all-triode front end would show up advantage.

An interesting thought!

In all this, of course, we have en talking only about the broad- t band. On higher signal fre- encies the position gradually al- s so that, for television sets, the tter is never in doubt. Triode RF ges win all the way; hands down, fact.

HAT DO YOU THINK

But what do you readers think out all this? You folk who have listen all the time to distant sta- ns?

Do you think an RF stage is cessary or do the people next door just as well with a comparable rial and a modern set without an stage?

Have you ever tried one of these ow-noise" front ends?

We'd like to know!

There is, of course, more to do than ere signal-to-noise ratio. T.S. can ithely take the triode grids to AVC d expect no trouble. It probably ouldn't matter, in his location, if ere were no control at all applied the front end!

The position would be very dif- rent in areas where one or more werful locals had to be dealt with. e conventional triodes mightn't take o kindly to excessive control volt- es, and we'd be stuck with all e troubles of distortion and cross- odulation that preceded the release super-control pentodes.

Such a prospect would be enough daunt any designer. An expen- ve tuner which wouldn't work close powerful stations would be a bad oposition indeed.

The same correspondent raises nother question relevant to distant idio reception.

Despite the selectivity of his tuner, e says that his night-time reception marred by "monkey chatter", used by the modulation compon- nts from an adjacent channel riding rough with the signal to which he trying to listen.

DEBAND PROBLEM

He is quite sure that the trouble is tie to this effect, because tuning ward the interfering station radually turns the monkey chatter nto recognisable musical overtones nd speech sibilants.

T.S. wants to know why these stray" sidebands do not beat with he carrier to which the set is tuned ather than the carrier to which they elong. This latter carrier is largely uppressed because it falls outside he pass band of the receiver.

Here I quote from the original etter:

"Put it this way. I tune in a station n say 1000 Kc. Now a statioin on 010 Kc is modulated by a 7 Kc note. his gives frequencies of 1017 and 003 Kc. This latter is only 3 Kc off esonance with the 1000 Kc station have tuned in and should beat with t to produce a 3 Kc note. But no, it roduces 7 Kc in the output!

Why don't I just get distortion in- tead of a scratching noise sounding or all the world like a speaker fault —until the offending station is pro- perly tuned in?"

Alas, T.S., I am afraid you have become the victim of your own eloquence. Have you ever observed the offending station when radiating a 7 Kc tone and noted that it re- mained 7 Kc when tuned to an adjacent carrier? The chances are that you haven't and are merely assuming that such would be the case.

In point of fact, the detector in your receiver is not at all fussy and will demodulate and produce result- ants from each and every frequency component present, irrespective of where the said components come from. This includes "stray" side- bands from the interfering station along with (possibly) a faint trace of its carrier.

The main output from the detector (fortunately) is the product of car- rier and sidebands of the desired station — in other words the wanted program. However, there will be a resultant also from the stray side- bands, beating not only with the carrier of the desired station but with each of its numerous side- bands.

In the process (and contrary to T.S.' suggestion) some frequency in- version does take place. The higher the modulating frequency on the interfering carrier, the closer will its sidebands approach the desired carrier. Thus a rising cadence in the adjacent signal becomes just the reverse when it appears as inter- ference on the wanted signal.

This basic principle is actually used in telephone channels to invert or "scramble" speech signals, there- by rendering them normally unin- telligible.

RANDOM PRODUCTS

In the case of interference, how- ever, the result is far more complic- ated than simple inversion. Mixed in with it are all the random pro- ducts of the two sets of modulation. No wonder that it earns the title of "monkey chatter".

The only recognisable thing about the chatter is that it has the rhythm of the interfering signal and it there- fore isn't hard to pick a dance band from a talk on fruit flies, even though the exact details may be a trifle obscure.

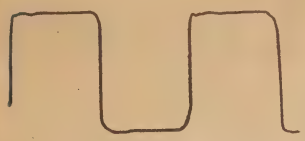
IN SUPPORT OF DUAL FEEDBACK

Dear Sir,

At the risk of protracting this correspondence unnecessarily I should like to refer further to the matter of dual feedback loops as used in WP's circuit (June issue) and in my own circuit which you did me the honor of publishing in the May issue.

The explanation for the poor results obtained by W.P. from the use of dual feedback loops would of course require detailed analysis and measurements of every relevant section of his amplifier, and without this I can only agree that the output transformer used by him may not have been as good as expected.

However, as some form of vin- dication of my own circuit, I determined on reading W.P.'s letter to run off a set of perform- ance figures for comparison and



for my own peace of mind! These are not as full as W.P.'s, but I think they serve the purpose.

At the time of taking the measurements given below, a first-rate English (Partridge) transformer was in use in my amplifier. Like W.P., my own laboratory gear is limited but I happen to know a fellow who . . . &c. and I was able to get the use of the gear at one of our tech- nical institutions for an after- noon.

In the course of making these tests and before the final figures were taken the balance of the feedback was altered slightly by increasing the plate-cathode feed- back resistor to .2 Meg—this gave a slight improvement on square- wave.

Measurements were made into 18 ohm resistive load at 10.89 watts:—

Frequency Response

Flat to 50 Kc		
60 Kc	*plus*	*1.2 db*
70 Kc	*plus*	*1.5 db*
80 Kc	*plus*	*1.5 db*
90 Kc	*minus*	*.9 db*
100 Kc	*minus*	*3.4 db*

Total Distortion

50 c/s	*0.22%*
400 c/s	*0.19%*
10 Kc	*0.33%*

I am also including a rough trace of a 10 Kc square-wave response taken on a Grainger type GRC 5A oscilloscope.

These figures are reasonable I feel. However, with the plate- cathode feedback disconnected and about 20 db feedback in the main loop there was chaos!

There was no static instability but the frequency response start- ed to rise at about 60 Kc and kept on rising to 100 Kc, beyond which it was not possible to measure at the time. The square-wave was anything but square at the output, looking rather more like a ragged picket fence!

Reducing the feedback to 14.5 db brought the amplifier back to sanity but gave distortion figures about double those for the dual- feedback condition, viz.

50 c/s	*0.43%*
400 c/s	*0.48%*
10 Kc	*0.69%*

This much at least is in accord with the results found by W.P. Whether any conclusions at all can be drawn from these sets of largely contradictory findings I'll leave to you and the world at large.

Yours faithfully,
C.H.

—BUSH FIRE BRIGADES!
—BOAT OWNERS!

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- In brand new condition.

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DON'T MISS THESE SETS!!

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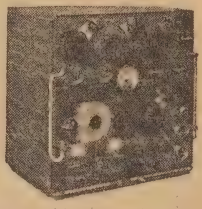
AT5 TRANSMITTERS



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Frequency modulated. Approx. 450 Mcs. Valve line-up: 9—6AG5; 2—2021; 5—6J6; 1—VR.105; also contains Genemotor. Input 27-volt, 1.5 amp; Output 285-volt, 60 M/a.

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Frequency coverage: 1.5 to 24 Mcs. 240 volt AC operation. Nine Valves. Crystal Filter. Specially designed to withstand exposure to high temperatures and humidity. Sensitivity better than 2 microvolts.

Dimensions: Height 11½in., width 2in., depth 12in., weight 74lb.

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ig station gradually restores the
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program can be enjoyed or
ired in the normal fashion.
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discussion about amplifiers with
feedback loops.
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is hardly necessary for me to
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y. As he says, the results are
sonable". More than that, I'd
they're very good and probably
inside the limiations set by
r items in the reproducing chain.

W DISTORTION

t lower power levels, the distor-
figures would probably be very
ll indeed.
hile this might set C.H.'s mind
est in regard to his own amplifier,
n't help but feel that his dis-
sal of the single-loop condition
been very summary.
rom his statement that the re-
nse is starting to rise at 60 Kc and
till heading upward at 100 Kc, it
uite evident that the feedback
not properly compensated.
der such conditions, it is quite
itable that a square wave should
reproduced like a "ragged picket
ce".
hese days, one shouldn't even
t to test such an amplifier until
response had been levelled off so
it did not rise anywhere appreci-
y above reference. I find it hard
elieve that such a condition could
be achieved with what is
cribed as "a first-rate" trans-
ner.
educing the feedback would
urally temper such effects but
ld not eliminate them nor put
amplifier in a fair condition to
, unless the phasing capacitor
oss the feedback resistor (or else-
ere in the circuit) were adjusted
eliminate peaks and obviate ring-

ME RESERVATIONS

n these grounds, we might accept
.'s verdict on his original hook-
but not on the single-loop version
which there was "chaos" or some-
ng a little short of it.
But even as I write these words,
ind myself wondering how long
will be before someone gets
und to measuring or assessing
practical significance of all these
h frequency peaks and ringing
cts. We've already suggested
t, with the best pickups and
akers, an amplifier sounds vague-
cleaner without these effects but
ere does imagination end and
lity begin?
How closely do transient wave
ms on a good orchestral record-
approach the rise time and
plitude of our "square" wave?
re imporant, how much of the
rshoot and ringing in the ampli-
survives propagation through
oudspeaker and a pair of ears to
oduce a significant stimulus?
Until we know the answer to these
estions, we are in danger of
coming slaves to a CRO pattern.

AN 8-VALVE RADIOGRAM

From Page 71

he usual practice, therefore, is ake this part of the set "on trust" the moment and attack the aerial, and oscillator stages. Trimmers uld have been mounted across section of the gang and these adjusted at the high frequency of the band. The coils will be d with adjustable iron cores and e are adjusted at the low fre- ncy end.

ake sure that the dial pointer is to coincide with the "set dial" k at the low frequency end of dial when the gang is closed. If dial has no set mark, set it just nd (about ¼in with the type glass used) the 550 Kc mark.

ow tune in a station on about Kc and note its position relative he dial calibration marking. If essary, adjust the core of the llator coil until the calibration is ect. Follow this up with adjust- t of the aerial and RF coils for imum signal strength.

ow tune in a station at the high uency end, between 1200 and 0 Kc. Use the oscillator trimmer ring this into line with the dial orations. Follow up with aerial RF trimmer adjustment to give imum signal strength.

EAT

heck again at the low frequency and correct any slight error that be apparent, then again at the frequency end. Intermediate ions should now line up with the calibrations. If they don't, it is ible that the dial is not correctly relative to the gang and you may e to repeat the procedure with a ntly different setting.

eak but steady stations are best sensitivity adjustments, though a ng local is often more convenient dial calibration, if only because more easily identified. Keep the ut from the speaker low, as the is more sensitive to changes at volume.

hen this section is completed to satisfaction you may tackle the channel. Once again choose a k signal, tune it in carefully and k at low volume. Give each ad- ment a half turn or so, noting inal position before disturbing it. an improvement is noted, keep g until the loudest signals are uned. Repeat with each adjust- t until all are peaked.

a multimeter is available it may set to the 10 mA range and con- ed in the 6N8 cathode circuit to e as a sensitivity meter. Increas- the sensitivity will decrease the er reading, due the AVC action, is much more accurate than ging level by ear. It will not rate on the secondary adjustment he second IF, the AVC being n from the primary winding.

the above procedure is carried carefully it should bring the set ly close to optimum performance will serve until the job can be e properly. Even with such tem- ary alignment the set should give od account of itself and bring in t of the distant stations which are th hearing.

OFF THE RECORD — NEWS & REVIEWS

It is often very difficult to select a "recording of the month". It is doubly difficult for a middle-brow release to head off so many good discs of weightier music. In giving the palm to the "Land of Smiles", I do so because of its easy and universal appeal, for its high quota of musical worth, and for an almost faultless performance by all who made it.

by John Moyle

LEHAR—Land of Smiles, Romantic Operetta featuring Elisabeth Schwarzkopf, Erich Kunz, Nicolai Gedda, and Emmy Loose, with the Philharmonic Orchestra conducted by.. Otto Ackermann. Columbia 33-OCX-1114-5.

To record a romantic operetta such as this, so full of sentimental traps which could fall into bathos, without the support of an actual performance, is not easy, particularly one which is linked so closely with the incomparable voice of Tauber.

To do it as successfully as Columbia, has done on these two discs, is something of an achievement. Very rarely do we hear four complete sides of this type without blemish, technical or musical. "Land of Smiles" deserves high praise because it does so completely what it set out to do.

WELL KNOWN SONGS

Nearly everyone knows some of the songs from the score. "You Are My Heart's Delight" is sung by almost every popular tenor of the day. But there are plenty of other numbers just as good if not so well known, and they are doubly delightful when they appear in their full sequence.

All the songs and dialogue are in German, but the story isn't hard to follow. If you have a few German phrases at your command you will have no difficulty in picking out many of them, for the diction is crystal clear.

Elisabeth Schwarzkopf has been heard in other operettas of this type. I doubt whether she has an equal at the present time. And once we have overcome our surprise that anyone else but Tauber could sing the tenor songs, we realise that Nicolai Gedda might fit his role even more appropriately—certainly he sounds more the youthful, eager lover than the late Tauber.

The recording is first class. Every voice is clear, quite free from any sign of strain or distortion. The orchestra gives a star performance in itself, perfectly balanced against the singers, always adequate and warm in support, but never obtrusive. The amount of reverberation is just right. It avoids a strictly studio atmosphere, but allows every detail of the superb scoring to be heard.

And finally the surface is as good as Columbia have ever produced. What a difference a noiseless background can make!

My five-star award is shared equally by performers and recording engineers. If you don't like these records you are either very old or you have no music in you.

SCHUBERT—Symphony No. 6 in C major. Played by the Bamberg Symphony Orchestra, conducted by Joseph Keilberth. Radiola-Telefunken NLB6082.

This is an early symphony of Schubert's, often called the "Little" symphony. It certainly is we named in comparison with No. written in the same key of C maj and known as the "Great".

It is a pleasant and bright wo but has nothing very much to h it together. Schubert, who reli so much on material rather th method in his orchestral wo doesn't unfold the same brand melody which shines through better known symphonies, and this respect the average liste might be disappointed.

Joseph Keilberth plays it with sense of "hurry", which certai brightens its already bright mo but also tends to make somethi of a scramble here and there. T orchestra is a bit behind him o or twice.

TREATMENT SUCCESSFUL

At the same time this treatm is more successful than any atte to invest a stature the music d not possess, although if anythi Keilberth has overshot the mark

I missed the roundness weight one associates with a g orchestral disc of today, but may have been part of the p to build lightness into the musi

I haven't any other recordings comparison, and I doubt whet there are many, so that if you wo like one of the sixth, this see to be it.

The surface, as with most Radi records of today, is smooth and lent. It is good enough to t an AES curve, which gives a w come lift to the top, and one no of bass boost, which adds b to it.

HANDEL—Double Concert in F major (No. 28). Played b the Berlin Chamber Orchestr conducted by Hans von Benda Radiola-Telefunken NLB6079.

No one could easily resist a cord of this calibre.

The music has much in comm with the "Water Music", and "Royal Fireworks", which have b recorded many times.

It is a 10-inch disc, despite eight movements—quite a leng work for those times. In it we h Handel at his brightest and b

It's date is not known, but it almost certainly one of Handel's compositions.

The recording is not exactly mote, although the amplitude is high. It has more-than-average verberation which gives it a c cert-hall atmosphere, fully in ke ing with the full scoring and consistent body of sound.

Occasionally this does conc some of the parts, but on the wh I would say the music is the b ter for it. The free use of ho

d wood-wind gives a richness to texture and the "grand manner" beautifully preserved.

The performance itself is first e. The "grand manner" has no ce of pomposity—it is always rm and human. The horn players serve special mention. They are avily laden, but play their part thout a break in tempo or tech-ique.

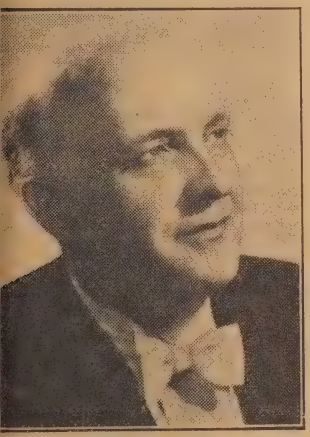
Technically the disc is good. erything has turned out well, d it plays cleanly and consistent-from start to finish There is no rface noise that I could hear—en the run-off at the end is sub-ed.

This is one of the month's best cs. Despite the pile which await-me, I played it through twice, t for the pleasure it gave me.

RAVEL—Pavane pour une infante defunte, A la maniere de Chabrier, A la maniere de Borodine, Sonatine, Mirois. Played by Robert Casadesus, pianist, Philips ABL3012.

This is the first of a set of records in which Casadesus will present the complete piano works of Debussy, on the whole a very good one. It is inevitable that with so much on a single disc there should be an uneven quality in performance and with music of this type not everyone's reactions are the same.

In general, I thought Casadesus needs to exploit the dynamics of the piano with the loss of some sensitivity. But his playing is crystal clear, and there are many occasions on which this is an over-riding virtue.



ROBERT CASADESUS

In the Pavane, for instance, I thought his desire to avoid pale colors gave him a rather matter-of-fact approach which could have been softened with advantage.

In the Alborada del gracioso, on the other hand, this treatment is very much more successful.

His right hand is particularly vivid in Une barque sur l'ocean, but the effect would have been even better with more effective support from his left. "La vallee des cloches" is good, although the Sonatine, an early work which won a competition organised by a music magazine, I thought the best of them all.

In this, Casadesus shows that he does not look at Ravel as a kind of earthy Debussy, as do so many pianists.

Neither the Chabrier nor the Borodin interludes made any impression on me—either the music misses the mark or Casadesus doesn't know what to do with it. Ravel is probably to blame.

The piano recording is if anything a bit remote, but is mostly convincing, and at times extraordinarily good. The surface is almost noiseless.

In brief, a good record. It would be necessary to pick over individual recordings of these pieces to better them, and that would mean many records instead of one. Plays best with an EMI curve with extra bass—the NAB would be ideal.

RIMSKY-KORSAKOV—Scheherazade Symphonic Suite Opus 35. Played by the Minneapolis Symphony Orchestra conducted by Antal Dorati. Mercury MG50009.

Regarded purely as a recording, this is in the highest class.

Mercury's single microphone technique produces a distinctive brilliance, unmatched in its way by any other studio.

"Scheherazade" is an ideal vehicle for it. Not only is it a show piece with few equals, but it provides a succession of vivid passages for almost every instrument.

Whereas the extremely forward recording might not suit everything, it is an outstanding success here. Something in the creation of solid color may be lost in sections such as the Young Prince and the Young Princess, which would have flowed a little more romantically from a greater distance.

On the other hand there is an opportunity to show off some fine string tone, and the wood-wind does not make the mistake of trying to compete with it.

WIDE RANGE

The dynamic range of the disc, as with all these Mercurys, is a vast thing, and makes such passages as the final storm quite tremendous in their force.

No opportunity is lost to show up the quality of the orchestra, which comes through the ordeal without a falter. Dorati handles it with an almost razor-like control, and its flexibility and response will delight you.

The wide dynamic range means that often the music is playing well down into the noise level, and I would have liked to hear a smoother surface. The tendency—and indeed the advice—to "turn up the wick" means that the surface must stand extra scrutiny, and wide range equipment will show that it is not completely quiet. Elsewhere, of course, the volume swamps it out.

The frequency range is wide, but the temptation to overdo the bass has been admirably withstood. At lower volumes, a notch of extra bass will be in order, but I thought the balance in every way was admirable.

I can't imagine a recording of Scheherazade with more brilliance and impact than this one.

Although AES curve is recommended, I dropped it down to EMI.

RAVEL — Bolero; RIMSKY-KORSAKOV—Cappriccio Espagnol. Played by the Detroit Symphony Orchestra conducted by Paul Paray. Mercury MG50020.

Both these can be regarded display pieces, and therefore legitimate material to show off an orchestra.

But I thought that here the exhibition is made at the expense the music.

Bolero, of course, is little more than calculated mental torture.

With the little boy who insists on hitting himself with a hammer many consider the best part is when it stops! On the other hand, plenty of people love every note.

In the Cappriccio Espagnol thought Mercury's single microphone had descended much too far into the orchestral bowels.

It did something to the strings too, making their tone far from pleasant—or are they really that way?

Plenty of it is very good, course. Large sections are vivid in the extreme, and very, very forward.

But there is a good deal of music in this piece, and very little of remains after the devilish Paray has sprung upon it, and with his cohorts, torn it to shreds.

Then it becomes just rowdy.

The surface on this side is almost silent, but there is some to be heard through the Bolero.

A record more to be prized for a brilliant noise than for a performance.

PUCCINI — Operatic arias from Manon Lescaut, Madame Butterfly, La Boheme, Suor Angelica, Gianni Schicchi, and Turandot. Sung by Maria Meneghini - Callas. Columbia 33OCX1204.

During the last five years, Maria Meneghini-Callas has become one of the most famous dramatic sopranos of the day.

She has done this by the amazing manner in which she has handled roles as different as those of Brunnhilde and Mimi.

Few singers of the past or present have managed to cover such a wide emotional range with success. But Callas has the artistry and the personality to make everything she sings sound convincing, sincere and alive. Everything she does is touched with authority.

Her dynamic range is quite exceptional. When she sings Mimi and Butterfly in a half-voice, beautifully produced and controlled, you will easily be deluded into thinking it to be her natural tone.

But, at an approaching climax her whole personality and vocal texture will change into a rich thrilling crescendo of almost incredible power.

Frankly I found this somewhat disconcerting, despite its spectacular effect. One just can't imagine Mimi about to die of consumption, singing like that, or Butterfly either. Moreover, any woman with such a robust psychology would be out of character in either part.

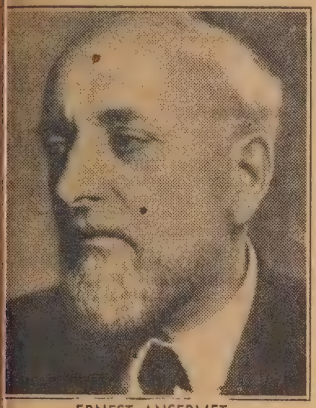
As a performance, therefore every one of these arias is a jewel. Considered as portions of opera, they are not completely consistent.

It is no wonder that such a voice should show a change in quality at

e extremities of its range. This true of Callas. Her full capacity, demonstrated in the excerpts from ıranđot, show distress, and elsenere a peculiar husky tone creeps which mars its sheen.

Nevertheless, this is a thrilling ece of recording by a magnificent ıger.

The recording has few flaws. ırely are there any dubious notes, though with such a voice there is enty of opportunity. The orchesa isn't named, but it does well ough to deserve a mention. Surface is first rate. EMI curve OK.



ERNEST ANSERMET

STRAVINSKY—The Fire Bird Suite, played by L'Orchestra de la Suisse Romande. The Symphony of Psalms, by the London Philharmonic Choir and Orchestra. Both conducted by Ernest Ansermet. Decca LXTA2916.

This record sounds like an early mple of Ansermet and the Suisse ɔmande. It has all the definition ıd brilliance we greeted with de-ght in the early Decca's, but the tch of excitement seems less than might have been.

A more forward recording would ɔbably have made a difference. maybe that of recent years we ıve become used to more successful recording with the close micro-ıone. True or false, I had the eling that the colors were rather ıde in this record.

There is, however, some exquisite aying. The Berceuse I thought ırticularly fine—first grade perrmance if ever I have heard it.

There is plenty of top response, ıt the bass is improved with some ıosting.

The Symphony of Psalms is a most ıusual work, written in 1910 for e fiftieth anniversary of the Bosn Symphony Orchestra. It is for chestra and choir, the latter sing-g in Latin excerpts from the Book Psalms.

The orchestra has no violins or olas, being composed of wood-ind and brass, supported by string ısses, tympani and two pianos.

It comes from Stravinsky's later ɾiod, in which he was deliberate-striking out 'into new orches-al country, avoiding at all costs ything that sounded like conven-ɔnal treatment.

For this reason, the symphony an important work, particularly to students and listeners who like to analyse just how it has all been done. It may well be the first LP release.

The recording, however, is only average. It is rather remote, and the voices suffer from some distortion on both loud and soft passages, which is characteristic of earlier LP's, even though the amplitude is not large.

I would rate the disc as interesting more for the music and the performance than for the recording. I'll leave you to judge.

SCHUBERT—Symphony No. 1 in D major, Symphony No. 2 in B flat major. Played by the Royal Philharmonic Orchestra conducted by Sir Thomas Beecham. Philips AO1138L.

These are Schubert's earliest symphonies, the First being written in 1813, and the Second in 1814, when Schubert was aged 16 and 17 years respectively.

We do not, therefore, find the Schubert of more mature years, although any young lad who produced such work today would be a sensation.

It is highly interesting, and somewhat amusing, to hear Schubert struggling to emerge from a pattern based on earlier composers with whom he undoubtedly became familiar during his student days.

We hear, too, many musical ideas which Schubert used in expanded form in his later works. There is a good deal of honest padding, but there is also tunefulness, vigor, and bright color which make both symphonies easy listening. Maybe there is good reason to talk of structural weaknesses in Schubert's orchestration, but it has never yet clouded the lovely music built upon it.

The composer's development between the two symphonies is quite marked. For that reason, the Second, I think, is the better work, and some of it as good as anything Schubert ever wrote.

Beecham proves an excellent conductor for these symphonies. The orchestra plays them with typical grace and charm. The recording, too, is bright and well-balanced, with a smooth, quiet surface. The EMI curve sounds best.

BACH — Brandenburg Concertos, No. 2 in F major and No. 5 in D major. Played by the Berlin Chamber Orchestra, conducted by Hans von Benda. Radiola-Telefunken LE6503.

This is a record of real quality. The Brandenburgs, six in all, are familiar to almost every lover of music, and certainly to those with a knowledge of Bach.

They are so called because they were written for the Elector of Brandenburg to whom they were dedicated in 1721.

In the No. 2, the concertino is made up of a trumpet, flute, oboe and violin playing with a repieno of harpsichord and strings. In the No. 5, the concertino is a violin, flute and harpsichord.

The Berlin Orchestra gives a bright, clear performance with a refreshing air of authenticity.

Particularly good is the unnamed harpsichord player, whose solo work in the No. 2 is worth special mention.

He may have been given a separate microphone, for as he proceeds with his part in the first movement of No. 2, for instance, someone has either swung a microphone into position or turned up its gain control.

At any rate, it is as full-ton an instrument as I have heard f quite a time. Too many harps chords in music of this type a thin and unimpressive. But he we have the real thing, and unle you have heard such a one befo you will be surprised how mu weight can be struck from it.

The No. 5 is perhaps the mc popular of them all, and I need s no more than that its performan is as good as I have ever hea on a record.

Technically, both sides sou round and full in tone, well ba anced, and with good instrument definition quite essential in suc work. There is no background surface noise—something which becoming a habit with Radiola.

Thoroughly recommended for Ba lovers. The EMI curve is best.

BEETHOVEN—Symphony No. 9 in D minor, Opus 125, played by The Hague Philharmonic Orchestra with the Amsterdam Toonkunstchoir and soloists, conducted by Willem van Otterloo. Symphony No. 8 in F major, Opus 93, played by the Berlin Philharmonic Orchestra, conducted by Paul van Kempen. Philips A00221L-A00222L.

This is the same recording as wa used by Philips for a release som time ago, and which I reviewe when it first appeared here.

The difference is that an entirel new set of masters have been cu from the original tape.

The first cutting was a straight forward LP job, with regular spaced grooves. It also split th second movement, simply because single side wouldn't hold two c them.

But this one has been made wit the latest techniques, including fre use of micro-grading, and with stylus which cuts an infinitel quieter groove. And all the move ments are in one piece!

GREATER RANGE

As a result, the dynamic range much greater than that of the earlie version.

At the same time, unless I am n mistaken, the bass has been booste to give an added resonance, whic has deepened the general pitch.

It is clearly to be heard in th drum beats of the second move ment.

In this new recording they soun rounder and fuller than in th original. If there is a loss in auther ticity, however, it is quite min against the richer sound this r inforcement has given.

I always liked this Ninth, and some ways it has the most succes ful vocal movement of them all. Th recording is more remote than some others, but largely avoids di tortion and other queer effects whi appear to lie in wait for enginee when they try to record choirs. Th soloists, too, are very good.

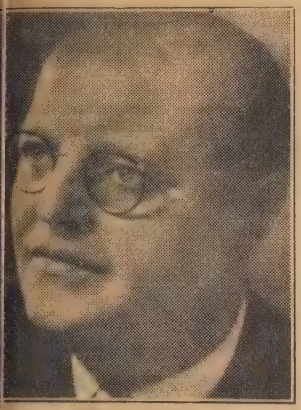
What it may lack in the spectacu lar, therefore, it gains by bein more playable than any of th others. And that's the thing th matters.

At the same time, this last move ment is a devilish thing to recor and I still live in hopes of hearin some day a miracle performance which sopranos neither shriek n

ral fortissimos disappear into a idy mess.

he fourth side is taken up with extremely good performance of Eighth symphony, again a some- at remote recording with a little e-than-usual echo which isn't in way objectionable, nor does it the general orchestral definition. is played with great vigor and re—a most impressive perform- e.

articularly attractive jackets in r set off this very fine set of s.



JOSEF KRIPS

SCHUMANN—Symphony No. in D minor, Opus 120. Men- elssohn—Symphony No. 4 in A ajor (Italian). Played by the ondon Symphony Orchestra, nducted by Josef Krips. ecca LXTA2887.

is only recently that I reviewed Schumann symphony as played the Philharmonia Orchestra, con- ted by Cantelli.

his Krips version is not as ent. It seemed to me that, aware he weaknesses of the work, and tendency to lose one's interest in ny passages, Cantelli tried to pe it more tightly than usual, I thought he did succeed in giv- life even when there was preci- little to be discerned.

Krips on the other hand endeavors build more stature into the music, does probably as well as it is sible to do.

ut I fear his impressive build- at the commencement of the last vement, for instance, only serves accentuate the anti-climax which us as the movement proper aks forth in all its banality.

t may be significant that I thought ter of the work after listening to ntelli, but no differently after ps.

is recording is quite as impres- as Cantelli's, however. The hestra sounds clearer and more ward, although it has no greater ght.

he Mendelssohn on the other d is not only bright and interest- but is played that way. Its mediate plunge into action against background of staccatto horns er fails to shine for me.

t was written during a tour of y, but appears to have little other ociation with that country. Its odies and orchestration are un- takably Mendelssohn as we hear him in the Hebrides and the Scotch symphony, although no doubt he attempted to strike a light and grace- ful line. Some can see allusions to Italian scenes in the music, but they do not greatly convince me.

I thought it easily the better side, and it is on the whole a very satis- fying performance.

The surface noise is a little higher than usual, although by no means bad. It played a bit edgily on the Decca curve, so I suggest you try the EMI which I found the best.

PROKOFIEFF—Symphony No. 7, Opus 131. Played by the Philadelphia Orchestra conducted by Eugene Ormandy. Philips AO1614R.

One of the month's most interest- ing and beautiful records. I have never heard the symphony before, which isn't surprising as its first per- formance was given in 1952 in Mos- cow, the year in which it was com- posed, and a few months before Pro- kofieff's death.

It was first performed in America by this orchestra and conductor in 1953. There is nothing outlandish about it, either in musical ideas or in treatment. It is illuminated by a fresh imagination, clear musical thought, and almost classical orches- tration. It has a distilled atmosphere —the product of concise construc- tion and clearly connected musical thought.

Of it, and its traditional four movements, the Russian paper Pravda wrote—"The first movement ranges from a children's fairy tale through romantic dreams to the first active aspirations of youth. The second is a symphonic waltz; the third is a brief but deeply lyrical and ex- pressive movement. The fourth combines the moods of a gay dance and an energetic march, spiced with humor and droll wit which appears so often in Prokofieff's music."

You may not extract all this at first hearing, but there isn't a bar which is unintelligible.

FINE PLAYING

Apart from the music you will undoubtedly be impressed by the magnificent playing of the Philadel- phia Orchestra.

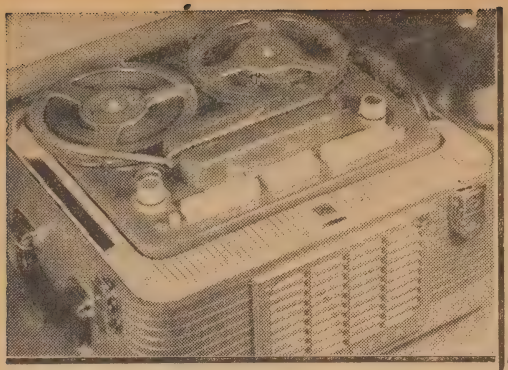
Magnificent I think is just the right word. Right from the start there is smoothness and power, and complete appreciation of the music. As usual the strings are particularly fine. They have a sheen, precision and vitality really good to hear.

The tone is firm and full, the balance sure and every part plays clearly and well. Add to this a silent surface and you have a par- ticularly fine record.

Not a big work, but no assess- ment of Prokofieff is complete with- out it.

SAD AM I WITHOUT THEE —A collection of songs of ardent affection, wails and plaints, as well as joyful songs and dances sung and performed on recorders and suitable stringed instru- ments by the Trapp Family Singers. Columbia 33 OSX7529.

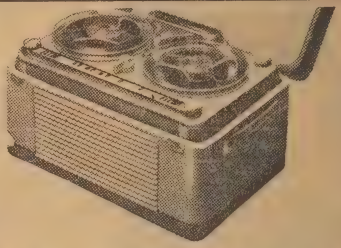
The Trapp Family is a real family of Austrian-Americans who have built around themselves a world of folk music, both vocal and instru- mental. Not only do they give re- citals in various centres, but operate



Apology

Magnetic Sound Industries wish to apologise fo any inconvenience caused to their clients by thei advertisement last month announcing that th new GRUNDIG Tape Recorders would be here We understand now from the manufacturer that, owing to the shipping strikes in England the machines will not be arriving till late Sept ember or thereabouts. The price will be announce in a later advertisement.

In the same advertisement, when announcing the release of the brand-new, twin-speed, twin-track ELCON, the price was mistakenly quoted. The correct prices for the two models are now: ONLY £140 for the 7-valve deluxe Radiocorder and ONLY £119 for the standard Elcon Tape Recorder.



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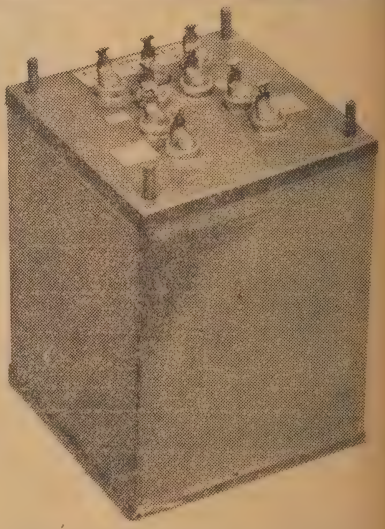
OUTPUT TRANSFORMERS

High Fidelity is the modern sound marvel. Many circuits will give virtual freedom from distortion but the output transformer is the real key to top-line results from any amplifier.

BRAMCO TRANSFORMERS have been designed for full frequency range, stability in a wide variety of circuits, and extremely low distortion. The windings are hermetically sealed against moisture and to preserve winding consistency. All transformers are cased and fitted with terminal connections. Prices are reasonable.

For your loudspeaker cross-over network BRAMCO can supply accurate inductances for any standard or special circuit.

If it's a special transformer or inductance you want, Bramco can design and supply it.



A BRAMCO 10-watt ultra-linear wide range output transformer obtainable in a variety of output impedances and screen tappings.

BRAMCO RADIO COMPONENTS

83 NELSON STREET, WALLSEND, N.S.W. Phone LL9211.

usic camp devoted to the revival family music.
)n this disc they sing a number folk songs from Austria, Ger- ny, England, and even include 'exas cowboy song.
nterspersed are items played on rder flutes with string bass ac- panirnent (or so it sounds), all e with a dedicated air and con- rable charm.
fost arrangements are by Dr. nz Wasner, a musician and priest) accompanies the family.
fostly its members sing as a choir. ough in several songs there is ery pleasant baritone soloist. All arrangements are good, and tly they are beautifully sung.
f the instrumental work the Trio recorders alone I thought the

he recording is most effectively e, and the surface a good one.
Trapp Family is bound to at- t a large audience here in Aus- ia, and this disc should be a ular memento of a unique musi- combination.

MOZART—Concertos for vio- n and orchestra in G major. 216. and A major, K219. layed by Jean Fourier and the ienna State Opera Orchestra, nducted by Milan Horvath. Vestminster WL-5187.

his disc has the authentic West- ster sound about it—clean, cry- -clear outlines, a forward, full- ge violin tone, and a frequency ge which puts up a brilliant ving on wide-range gear.

i fact, it is very hard to fault. oth concertos are early works. conductor and violinist have ly been satisfied to let the music ik for itself, which it does most uently. The tempo is steady the ing relaxed, and the sound con- ntly good.

verything about Mozart is so ious that it is little more than ual to say that these concertos e written when he was barely years of age. Of the two, the ajor is probably the best known, ough there are few recordings in circulation. Fournier's play- of the exquisite third movement erhaps the best thing on the disc.

he violin tone seems to be better this side than in the G major, re the recording seems a little at times.

would also have liked a some- t brighter tempo, particularly in final movement.

he Vienna State Orchestra plays he Vienna Konzerthaus and is rded with its usual fine bal- e, Horvath conducts it in per- sympathy with the soloist and nically the balance between them rst rate.

found the NAB curve best—it ced an otherwise sharp edge he violin and gave an admirable to the orchestra.

he surface is extremely good

BRUCH—Concerto No. 1 in G inor Opus 26. (MENDELS- OHN) Concerto in E minor pus 64. Played by Campoli iolin)) and the London Phil- rmonic Orchestra conducted Eduard van Beinum. Decca XTA-2904.

ll in all, it is very hard to resist claims of this as being the best rding of both concertos.

I cannot say whether it is the same version of the Mendelssohn as was issued some years ago, on a 10-inch disc. There is little reason to discount it if it is.

Campoli isn't the most brilliant of violinists, nor the most powerful. But he has a sincerity, charm, and musicianship which are just right for these works.

Even the Bruch concerto is invested with this sincerity, enough to discount over-purple sentiment.

As most people who like the one will also like the other, this disc looks a winner musically and financially.

NIXA DANCE DISCS

Nixa continue to make a name for themselves through a series of excellent dance releases with authentic music covering the popular sambas, rumbas, mambas, &c., which are the key to youthful entertainment today.

Some of them include the more conventional foxtrot, which seems to have taken over all the rest.

In the four records mentioned below a high standard is maintained. Not only is the playing good, but the rhythm dances have an air of the real thing.

Compared with them, some routine 78's of the same music are characterless and tame.

On LPY121 Pepe Nunez and his Orchestra Typique play four tangos on one side and four paso-dobles on the other.

On LPY123 Ben and his Tropical Rhythm Kings play eight typical dances (baiao, guaracha, mambo, samba-lente, samba and bolero)—a very good disc.

On LPY122, M. Philipe-Gerad and his Ensemble are more conventional in eight danses modernes.

All these discs sound most impressive on good equipment and technically they are first rate.

On SLPY143, Red Camp plays on his concert grand a number of popular numbers including Summertime, Tenderly, Laura, and What Is This Thing Called Love. This is a Cook original, but I found Red Camp very free with his material, and somewhat hard of tone in his piano. He has a big reputation overseas.

Vital and authentic Flamenco music is played by Carles Montoya in a Fiesta Flamenco. This is another Cook record, and it is more a faithful account of musical and dancing sounds than a Flamenco recital. It may be sounds of our times, but not as purely musical as some other Nixa Flamenco records.

ALBUMS

Record albums seem to be on their way out.

Instead, it is becoming standard practice to house each set of two or more records in a combination box-folder. The discs retain their individual envelopes, and the whole thing sits on a shelf more conveniently than an album.

The back of the box bears the name and identification of the recording it contains.

This method of packing will be adopted for all EMI releases in the future. Where appropriate, descriptive leaflets or booklets will go with the records.

The Land of Smiles, reviewed in this issue, is treated in this way.

SHORT-WAVE NOTES BY ART CUSHEN

NEW STATIONS FROM VIETNAM

Several new transmitters have been heard operating from both North and South Vietnam, while stations in the States of Laos and Cambodia have also been heard.

STATIONS in the communist area of North Vietnam have been broadcasting from Hanoi. The most consistent signal is that of "The Voice of Vietnam" which is also the slogan of the Government broadcaster over the border in Saigon, both stations therefore claiming the same slogan.

The Hanoi transmitter which appears to have been taken over from the evacuating French Forces some months ago has been operating with lower power on both 11995 and 9955 Kc. It has also commenced broadcasts on 7320 Kcs varying to 7420 Kcs, and on this frequency provides much better signal strength.

The transmitters all carry a programme of English news and commentaries, followed by music, from 10.30 to 11.00 pm daily.

Not much information has been gathered about stations in North Vietnam and we are hopeful that a verification will soon be received and this information passed on to our readers.

SOUTH VIETNAM

The recent change of time zones in this country has reverted to three hours behind AEST, instead of the former two hours. "The Voice of the Vietnam National Army broadcasting on 258 and 41 metres broadcasting from "Saigon" is the announcement given during the English news broadcasts from 10.15 to 10.30 pm daily.

This station was formerly in Hanoi and as the Voice of the French Army, known as Radio Hirondelle. A move was made to Saigon, and transmission conducted on 7180 Kc, 8.30 am-2.00 am.

The Vietnam National Army station appears to have replaced the French Army station and is now using the new frequency of 7255 Kc, and is being well received at present.

CANADA ADDS CKNK

THE Canadian Broadcasting Corporation at Montreal has added a new frequency to the International Service. It now operates CKNK on 11945 Kc along with CKLP on 9585 Kc.

Both these transmitters carry the North-West Territory transmission in English 12.55-1.35 pm daily. This transmission consists of messages to people in the Far North who are isolated for much of the year and are dependant on the CBC broadcasts to keep them in touch with the outside world.

The transmission to Australia and New Zealand is broadcast 10.55-11.15 am on CKCX (15190), CKLO (9630) and 6.45-7.20 pm on CKLO (9630) and CKNA (5970).

BELGIUM CEASES FOREIGN BROADCASTS

THE Belgium National Radio Station ORU at Brussels, has ceased to carry any foreign languages for its Overseas Services. These are now broadcast only in the native tongue of French and Flemish, and are still broadcast on the former schedule of these languages.

The announcement of this cut in overseas broadcasts from ORU due to restricted budget came as a blow to the many friends of the station overseas.

The DX session, and the very popular "Amongst Friends" were programs much in favor with listeners.

The Belgium National Broadcasting Service first came into prominence during the war years when the station commenced to broadcast from its temporary home at Leopoldville, Belgium Congo, the temporary home of many of the Belgium activities which were evacuated before the German invasion. It was also the home on the opposite bank of the Congo River of the Free French transmitters at Brazzaville.

The headquarters of OTC, "The Goodwill Station", remained at Leopoldville, and the world-wide popularity poll of the ISWC, London, in 1950, found OTC the most popular station.

During this period the Belgium National Broadcasting Service were building a new 100.000 watt transmitter at Wavre. In 1951 the programs were broadcast from the Belgium station ORU, the Leopoldville transmitter acting as a relay station. Its situation was ideal for broadcasts to North and South America.

> News from readers and enquiries should be sent to Arthur Cushen 212 Earn Street, Invercargill, NZ. All times are Eastern Australian.

In 1953 the ISWC Poll found that the new ORU had slipped to fourth place, the main reason being the station's poorer coverage for European listeners, due to the change in proximity to the Continent.

So far we have had no news of the use to which the Wavre transmitters are to be put during the hours in which they were normally employed broadcasting in foreign languages.

The fate of OTC Leopoldville has already been noted. This station has joined the barrage of transmitters of the Western Nations in the three daily broadcasts in the Russian language. It is a far cry from the former Goodwill broadcasts to its new role.

NEW FREQUENCIES FOR ALL-INDIA RADIO

ALL INDIA RADIO, is using new frequencies, and the English News broadcasts are as follows—

12.30-12.45pm Delhi 4990, 5955, 7285, 9720, 11920; 15400. Bombay; 6150. Calcutta. 4880, 6010. Madras 6085, 4920. Mysore 4800.

6.00-6.10pm Delhi, 7290, 9620, 11705, 15290, 17760. Bombay 9550. Calcutta; 7210. Madras, 6085.

10.30-10.35pm Delhi 6190, 9720, 12030, 15330. Bombay 9550. Calcutta, 7210. Madras, 4920, 6085.

1.30-1.45am Delhi 4990, 5990, 7210, 9510, 9720, 11925. Bombay 6150 Calcutta, 4880, 6010. Madras 4920, 6085. Mysore, 4800.

from World Radio Handbook.

FLASHES FROM EVERYWHERE

CANADA'S salute to the 25th anniversary of the International Short Wave Club, London, will be broadcast on Monday, September 5, 6.45-7.15 pm on CKN (9630) and CKNA (5970).

The transmission on Sunday on the frequencies has a very interesting Letter Box program, and during the answering of listeners' mail, mention is made of a monthly program booklet which is obtainable by listeners simply by writing to Radio Canada at PO Box 6 Montreal. Canada.

LISBON'S transmission to the South African area is now released on the frequencies, 11996, 15125 and 17835 3.30 to 6.30 am.

PEKING'S English broadcasts at 1 pm are now on 1130, 11690, 11960, 15 15105, 15130, while at 7.00 pm the 9655, 11 11690, 15060, 15105 are used. Peki third transmission in English broade 12.30-1.00 am is carried on 9025, 9 11300, 11690 and 15060 Kc.

BAGHDAD'S 85 metre transmissions 3297 Kc carry Arabic on all transmissio 2.00-4.00 pm, 11.30 pm-6.00 am and IS reports that they are verifying with new card.

VOICE OF AMERICA relays in Kore are relayed by Korean Broadcasting S tem stations Pusan (7935), Pusan (251 Taegu (4775) between midnight to 12 am and 8.30-9.00 am. The Mandarin pr grams are carried by the Taipeh Taiw station BED7 (7130) 1.00-1.30 am a BED4 (11920) from 7.00 am to 8.30 a

FORCES BROADCASTING SERVI at Benghazi, Libya, has been heard good strength in both Australia and N Zealand, and George Hughes of Adelai states best reception with him is on Su day morning when sign off is 8.00 a The station closes other days at 7.00 a with a goodnight Lights Out on a bug then the National Anthem. The fr quency of 4940 Kc is used, and thou this is very close to the Brisbane tra mitter, on 4920 Kc, the interference not very severe. The station uses o 250 watts, and was verified some mon ago when the transmitter was loctaed Tripoli.

JAPAN'S short wave commercial tra mitters operated by the Nippon Sh Wave Broadcasting Company, Tokio, h ended the test broadcasts on JOZ3 9595 Kc which we mentioned last iss The broadcasts on JOZ3 were well r ceived at Marrickville, NSW, by Edwa Williams, who reports good signals at pm.

The transmitter has not been no over the past few days, and one rep has it that an announcement heard r cently mentioned that tests on 9595 had been concluded in the meantim JOZ (3925) and JOZ2 (6055) are s being heard with English news at 7 pm.

DELHI'S transmission to South-Ea Asia with English news at 10.30 pm 12020 and 9525 Kc, these new chann replace 11875 9770 Kc.

CANADA'S CFRX broadcasting fr Toronto on 6070 Kc has a fair signal 8 pm when a broadcast of news is pr sented. This 1000 watt transmitter r lays the broadcast band transmitter 1010 Kc using the call sign CFRB.

The station which is now on Easte Daylight Time, also has been hea closing at 3.00 pm. The station is operat by the Rogers Broadcasting Company a verifies with a bright card which sho a map of Canada imposed over the sk scraper skyline of Toronto.

THE HAM BANDS WITH BILL MOORE

tional Field Days are always well supported overseas, but for some reason they have never racted much attention in this country. This is strange in a country where open air life is so much part of our everyday life.

ATIONAL FIELD DAYS are very popular events in the US, and last some 8000 radio amateurs were in field.

me interesting rules are incorporated he event, run annually by the ARRL, nsure that the varying power inputs he competitors are allowed for in the compiling of scores. The scope of the est is wide enough to allow all ons interested to compete.

tries are divided into five classifica-s:

Club or non-club group portable ions (three or more operators).

Unit or individual portable stations or two operators).

Mobile stations.

Home stations operating from rgency power supplies.

Home stations operating from cial power sources.

ations using portable equipment must up their gear within a 1000ft radius. ll amateur bands may be used but the ration of more than one transmitter he one time in the same band is not wed. Transmitters on different bands be operated simultaneously. Cross d contacts are not permitted. The test period is for 24 hours.

coring is one point for each contact varying multipliers. They are as ows:—Multiplier of three for power its of under 30 watts, two for power its between 30 and 100 watts, one for its between 100 watts and 1 Kw.

urther multipliers are three for all ions using equipment independent of ns, one for stations using commercial er and an additional multiplier of or stations using battery power. These tipliers do not apply to home stations.

ne operation of home stations using rgency power supplies provides an ellent exercise for amateurs in areas ly to be affected by emergencies, in ct the event is a simulated emergency ration.

nese US events are dedicated to emer-cy communications preparedness, and ry opportunity is given stations to ipete.

TV INTERFERENCE

HE initial meeting of the combined VHF and HF, BCI and TVI com-tees of the NSW Division was held on gust 2 under the chairmanship of Dr. Black, VK2QZ, the division's BCI and officer.

is the desire of the combined com-tee that every possible avenue is lored to ensure that early action is en on possible TVI. The meeting was important venture in amateur radio vity and their work will be followed h interest by all amateurs.

erc Healy, VK2APQ, acted as secretary the committee.

he meeting discussed and planned adly on many aspects of BCI and TVI decided to work first on BCI and cures and so establish a procedure method of approach to the forth-ning problems of TVI. It is hoped that ly solutions will arise from this ex-ience.

was decided to set up an organisa-to train at least 40 amateurs on the se, recognition and cures of types TVI. These amateurs should form the leus of any committees set up in l areas for TVI work.

hey also hope to work in close liaison h the PMG's Department and form t of an Australian-wide organisation ering BCI and TVI. Meetings will held monthly and it is planned that scheme will be operative before the ent of TV in this country.

CONTEST ON 144 MC

THE 144 Mc mid-winter contest of the NSW UHF section run in July was well supported with 30 stations operating on the first evening.

VHF contests are conventional from the point of passing numbers only, and personal exchanges are infinitely more interesting.

Stations farthest afield were VK2JX, Wentworth Falls, and VK2RU, Gosford. During peak operating periods the band was extremely congested, 39 different stations were active during the two four-hour operating periods.

The winner of the event was Ted Howard, VK2XX, with 54 contacts. In second place Peter Adams, VK2JX, Adrian Rofe, VK2HE, and VK2ADY, Mobile Station of the Gladesville Radio Club tied with 53 contacts. A further tie was recorded for third place between Perc Healy, VK2APQ and John Thornthwaite, VK2ATO.

VHF LECTURES

THREE lecturettes were presented at the August meeting of the NSW VHF section. Dr. Bob Black, VK2QZ, lectured on VHF equipment, Barry Goodman, VK2ZAG covered specialised components for VHF amateurs, and Bob Winch, VK2OA Class C Modulators.

Some extremely interesting lectures have been arranged for future VHF meetings.

Neville Williams, VK2XV will repeat his lecture an "Outline of Television" previously presented to the NSW section of the IRE.

Dr. Bill Davies of the CSIRO will lecture on Transistors, and Max Sobels, VK2OT, will continue his discourses on Television.

VHF IN THE WEST

WALLY HOWSE, VK6ZAA, contributed the following notes on VHF activity in the West.

The July meeting of the VHF group was held at the residence of Don Graham, VK6HK. A motion was passed expressing concern at the proposed changes to the 50-54 and 144-146 Mc/s bands. Despite the advantages of the harmonically related 56-60 Mc/s band, it was felt, that as the change is not universal, it will preclude any further investigation of DX propagation and the effect of the increased solar activity.

While crossband contacts overseas would theoretically be possible, the operation of TV transmitters on Channel 1 in Australia and channels overseas in the 56 Mc region would eliminate any chance of a repeat of the DX contacts VK5KL to W7ACS/KH6 and VK6HK to VR2CG.

The group was disappointed that the 50 Mc band will be lost and that use may be made of Channel 1. Sporadic-E-caused interference is likely to occur with any TV signals on this channel.

A check of only three VK6 logs showed that there was interstate reception for at least 29 days each summer every year since 1951. Every year since 1949 has seen VK6/ZL contact all with 100 watts, not 100 Kw.

Rollo Everingham, VK6BO, gave a very informative lecture on the design and operation of valve testers and illustrated it with circuits of his own.

Again an offer is made to help any amateur in WA to get going to 144.

Members will only be too pleased to arrange a portable expedition to a country QTH. Contact should be made with Wally Howse, VK6ZAA, 53 Ellen St., Fremantle.

ALBURY CONVENTION

THE 1955 WIA South Western Zone's (NSW Division) Convention will be held at Albury over the long Six Hour Day weekend with a programme covering Saturday, October 1 and Sunday, October 2.

The venue, central to many amateurs in both NSW and Victoria, should assist in assuring a record attendance. Twenty-six amateurs attended a preliminary meeting held in July at Albury to make arrangements for the convention.

Fuller information will be available from zone members or direct from zone officer, Jim Edge, VK2AJO, of Coolamon, or from Don Haberecht, VK2RS, of Albury. Programmes will be distributed to interested amateurs.

The arrangements include a tour of the Hume Weir on the Saturday afternoon, a dinner in the evening with films, pick-a-box, scrambled tunes, and other competitions.

Field events will be featured on the Sunday.

They include transmitter hunts on the 144 and 3.5 Mc bands and an additional blindfolded search on 144 Mc. A one-hour scramble will also be conducted. Latest details will be presented over the Sunday morning VK2WI broadcasts. Albury should see an influx of amateurs in early October to attend the SW convention and enjoy the fraternity of these events.

ANTARCTIC LECTURE

LECTURER at the July meeting of the NSW Division of the WIA was rare DX, Bill Storer, VK2EG, ex VK1EG, recently returned from Antarctica. Bill displayed interesting color films of the Mawson Base, Antarctica, and the surrounding area.

The films taken by members of the expedition were later edited for general display. Bill also showed a number of color slides. He regretted he was unable to spend as much time as he would have liked on the amateur bands.

Bill was still able, however, to supply some hundreds of stations with a new country. The films and the explanations provided were presented to a capacity house, 120 members attended.

Short wave listeners interested in the formation and supporting of SWL section in the NSW Division of the WIA should contact the secretary Harry Hicken, VK2ACH, Box 1734, GPO, Sydney. A number of persons have suggested the formation of the group but the real necessity is to obtain SWL's keen enough to conduct the section.

SILENT KEY

IT is with deep regret the passing is recorded in late July of Reg Anthony, VK2TR, who was an active amateur since the early 30's.

Originally signing VK2HR he lost that call to the B/C station. His next call was VK2AEC and later VK2TR.

Active mainly on the 14 Mc band where DX was the attraction and relaxation, Reg was for a period a councillor of the NSW Division of the WIA.

He assisted the division on many occasions with gifts of equipment for conventions and similar events. VK2TR was perhaps best known for his work with the Lakemba Radio Club and Experimental Radio Society of NSW.

The sympathy of all amateurs is extended to his wife and family.

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Fit a windscreen de-mister and enjoy safer driving. Prevents windscreen fogging. Keeps vision perfectly clear so that you can relax and drive in comfort. Operates from car battery. Low battery consumption. Draws only 2 amps. Easily fitted. No holes to drill. Suction cups hold it firmly against windscreen. These de-misters are strongly made and have an attractive appearance. Supplied complete with switch and flex.

Reduced from £3/10/- to £2/5/-, postage 7d. extra. A mighty bargain. Please state whether 6 or 12 volt model is required.

Weld your own car and save £££'s

with the electric welding kit with a thousand uses. Welds cracks and holes in car bodies, mudguards, radiators, etc. Repairs motor cycles, domestic appliances, sheet metal work, etc. It solders and brazes, too. Many useful articles can be made, such as Station Wagon Bodies, Radio Chassis, Caravan Bodies, etc. The kit is easy to operate, and it quickly pays for itself in time and money saved. Works from 6 or 12 volt battery. Send now for this complete welding kit, comprising a high-grade welding tool, earth cable, welding goggles, assortment of welding rods, fluxes, electrodes, and complete working instructions. Terrific bargain. This complete welding kit is yours for the amazingly low price of £7/7/-, delivered free to your address.

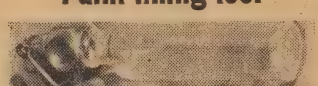
Saw sharpener tool

Will sharpen a saw in 30 minutes. No skill required. This tool is as easy as A-B-C to use. Sharpens teeth perfectly and to correct angle. Even if you have never sharpened a saw before, you can now sharpen a saw with the greatest of ease. To clear for only 29/6, postage 1/5 extra.

Panel beating kits—sensational reduction

Improve the appearance of your car. Increase the value of your car. Remove dents the easy way. You can panel-beat your car for a fraction of the cost of sending it out for body repairs. Restore bodywork to its original condition. This high grade panel beating kit will repair damaged mudguards, doors, bodywork, etc. . . . It's so easy to use. Anyone can operate the kit. The instruction book supplied shows you the quick easy way to panel-beat. These tools are made of the best quality forged steel. Reduced from £5/5/- to only £3/19/6, plus postage. POSTAGE RATES: Vic., 3/8; Q'ld. and W.A., 8/4; all other States, 6/-. Send for your kit TODAY, and save money.

Paint lining tool



Ever tried to paint a line on a car? You know how difficult it is. Then you'll appreciate how wonderful a tool would be which can paint nice straight even lines. Here's the very gadget to do the job. Just fill the tool with paint, run it along the job, and you'll get the neatest line you ever did see. If you want a straight line, simply place a rule on the job, and run the tool along the edge of the rule. You can do curves and fancy designs, too. It's an ingenious little gadget. To clear for only 25/-, postage 7d extra.

P.S.: It's very good for cycles, motor cycles, prams, toys, etc., as well as cars.

Electric engraver

Operates from any 6 or 12 volt car battery. Low battery consumption. Engraves on all metals. Engrave your name on your own tools for your protection against theft. Also engraves name or fancy designs on cigarette cases, silverware, brooches, metal tags, etc.

No skill required to operate. Reduced to 45/-, postage 11d. extra. Terrific value.

ENGINE TYRE PUMP

End back-breaking labor of pumping tyres

Just remove a spark plug and screw engine pump into plug hole. Start motor, and your tyres are inflated in a jiffy. Fits any size plug hole. Suitable for all makes of cars, including big American cars, trucks and tractors. Inflate your tyres the easy way. Engine pump, complete with 15 feet of hose . . . reduced from £4/10/- to £3/9/6, postage extra. POSTAGE RATES: Vic., 1/10; Q'ld. and W.A., 3/9; all other States 3/-. Send now for this sensational bargain.

16 DRAWER STEEL CABINETS

16-drawer all-steel cabinet for storing small parts, tools, nails, screws, bolts, etc. Each drawer is 1¼in x 2¼in x 5¼in in size. Will hold parts or tools up to 5¼in in length. Identification cards can be fitted on each drawer. Strongly made and most useful. Attractive appearance, and finished in baked enamel. Keeps your workshop tidy. Saves time searching for lost parts, etc. Ideal for motorists, mechanics, hobbyworkers, garages, shops, etc. This is a really outstanding bargain. Reduced from £3/15/- to £2/15/-, plus postage and packing. POSTAGE RATES: Vic., 6/8; Q'ld. and W.A., 13/8; all other States, 10/-.

SPRAY GUN

The air in your spare tyre operates t gun. Very easy to use. Simply fill the g with paint, connect the hose to spa tyre, press the trigger, and it spra beautifully. Sprays enamels, paints a lacquers.

This miniature spray gun is very usef for spraying damaged paintwork on mu guards, bodywork, motor cycles, kitch chairs, toys, or anything of small siz Supplied fully complete with hose a instructions. Amazing bargain. Reduc from 67/6 to 52/6, postage 1/3 extra.

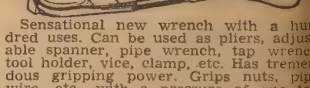
SPARK PLUGS—prices slashed in half

Brand new spark plugs, in perfect co dition. Reduced from 8/6 to 4/3 each, po free. Terrific bargain. Please state mak of plug you require, and the make an year of your car, truck, or tractor. We'v only a small quantity of plugs to clear this amazingly low price. Send yo order NOW. Don't miss this outstandin bargain.

Pipe stocks and dies

Set of stocks and dies for threading ¼i ⅜in, and 1in pipe . . . very strongl made . . . fast cutting . . . perfect threa . . . easy to operate. The complete set in cludes stocks, ¼in die, ⅜in die, 1in die an bushings. The bushings ensure that th thread is screwed on in perfect align ment with the pipe. To clear for onl £5/19/6, plus postage. POSTAGE RATES Vic., 3/8; Q'ld. and W.A., 8/4, and a other States, 6/-.

Wrench of 100 uses



Sensational new wrench with a hun dred uses. Can be used as pliers, adjust able spanner, pipe wrench, tap wrench tool holder, vice, clamp, etc. Has tremen dous gripping power. Grips nuts, pip wire, etc., with a pressure of one ton Can also be locked on the work, thu leaving the hands free. Removes broke damaged or rusty bolts, nuts, screw studs and cotter pins. Indispensable fo handling sheet iron and barbed wir Just the tool for motorists, mechanic farmers, plumbers, handymen, etc. Thi tool is exceptionally strong, and does th most difficult jobs with ease. Terrifi bargain. Reduced from 45/- to 30/-, post age extra. POSTAGE RATES: Vic., 1/10 Q'ld and W.A., 3/9; all other States, 3/-

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47 McLeod Road, Carrum Victoria.

REPORTING CODES

TLE has been heard of the RSM ode, a system for reporting Tele- v signals, since it was voted upon ie National Societies comprising the national Amateur Radio Union.

was originally sponsored by Euro- societies and favored by the major- f IARU members. The ARRL did ie the system and this factor will ubtedly affect its universal adop-

e M section of the code from M1 5 was only a partial answer to a report on quality.

AST OF 50-54 BAND

LLOWING approaches by the Federal Executive of the WIA the PMG's rtment announced that the 56-60 Mc would become available from mber 1 and that operation to cease ie 50-54 Mc band on January 31. The igement allows an uninterrupted d for the Ross A. Hull Memorial hy to be run during December and ary.

QSL ADDRESSES

e following are the changes in ad- resses in QSL Bureaux since the shing of the list in the March issue. w addresses are as follows:—British na: Desmond E. Yong, VP3YG, PO 325, Georgetown. Dominica: VP2DA, 64, Roseau Dominica, Windward ds. Nicaragua: YNIRA, Apartado Managua, Uganda: PO Box 1803, pala.

TVI FIGURES

IL RAND, WIDBM's survey of TVI n the New England section of the throws some light on the extent of caused by amateur stations.

e figures are based on a 50 pc return questionnaire. The question of in- rence experienced is as follows: pc of the stations replying caused TVI, 32 pc had slight TVI, 7 pc medium TVI and 2 pc had bad

e result of the poll indicated how ern TVI reduction techniques are ng dividends.

DX CONDITIONS

NOTICEABLE improvement was re- orded in the 14 and 21 Mcs condi- during July, better than those rienced here in June and a vast rence to those of the winter of 1954. appears that our sun-spot worries over and the DX fraternity can e down to serious business.

cellent openings occurred both in mornings and afternoons on 14 Mcs all continents appearing at times. ca, Europe and South America in AM, and all continents except South rica in the PM.

st DX heard was CR4AL and FF8AG TU was making the most of the itions and keeping check on the for his "Month on the Air" fea- appearing in the RSGB Bulletin. ning propagation conditions on 14 next summer should prove ex- ely interesting.

me extremely strong signals from West Coast of the US were still ning S8 to S9 hours after the peak. HZ's signal was a case in point, result it would appear from much er and many elements, he could not VK replies to his CQ's.

tober will be a busy month. First t is the VK/ZL DX contest, fol- ed by the international DX contest the weekends, October 22 and 23 October 29 and 30.

ve, YJ1DL, reports that 14 Mc is the useful band at Port Vila. He is he lookout for VK's, especially those whom he worked in Sydney. Gener- active in the late afternoons on Mc, Dave would appreciate calls. e's home-made QSL cards have been ived by many stations—his wife pro- es them

he journey of P. J. Mullock (G3HPM) of the Cambridge University Wireless Society, to Gough Island will be of considerable interest to the DX fraternity. The Gough Island Scientific Research Expedition left England recently and has been licensed to operate an amateur station under the call sign ZD9AR. G3HPM will be active from there on all bands from 1.8 to 21 Mcs.

Gough Island is 260 miles south-east of Tristan da Cunha in the South Atlantic.

In the June issue mention was made of Terry Tatham, who is confined to an iron lung at Cherrywood, Pacific Highway, Turramurra. Terry now runs a receiver, has books on amateur radio, and obtains much pleasure from his delving into amateur affairs, especially on the 40-metre band.

The Marconi School of Wireless has arranged a special course to assist Terry in his quest for further knowledge in the radio field

Dr. Adrian Rofe, VK2HE, a regular visitor, reports that Terry has a new interest with his ability to listen on 40.

Amateurs who could possibly visit Terry at the hospital would be very welcome. It will allow him to see in person the amateurs he listens to for hours on end.

AT LAST THE ELECTRIC ENGRAVER THAT WORKS OFF ANY 6 OR 12 VOLT CAR BATTERY

29/6

Complete with Instructions

Engrave your own tools, name plates, dog collars, cutlery, watch cases, cigarette cases, etc. Engraved articles are never stolen.

ENGLISH SMITH 8-DAY CLOCKS

As used by the R.A.F.

Luminous Dial

£5/15/-

Makes ideal car clock

Fitted with Sweep Second Hand Ideal for any car or truck.

Now you can make your own music box with these Swiss music units. They can be fitted to any type of box, doll, jug, teddy bears, etc. Hours of enjoyment for all the family.

30/-

EACH

Tunes available, Lili Marlene, Jingle Bells, Blue Danube, Harry Lime Theme, Wedding March, The Merry Widow, Happy Birthday, Annie Laurie, How Dry We Are, Roll Out The Barrel, Silent Night, Teddy Bears' Picnic. Also available, a few only double units which play 2 tunes, 50/- each. Miniature Music Units fit cigarette case, Lady's Compact, etc., 39/6, also 230 volt Music Unit, works continuously, 59/6.

JUST ARRIVED TELESCOPES

Latest Model, complete with Tripod.

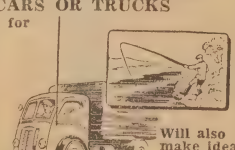
Achromatic Coated Lens.

£9/15/-

Ideal for Rifle Shooters. 25 Magnifications.

STEEL ARMY TANK AERIAL RODS WILL MAKE IDEAL RADIO AERIALS FOR CARS OR TRUCKS

Too long for postage. Advise nearest railway station. Bases to suit Aerials. 12/6 each.



Will also make ideal Fishing Rods.

12ft long, 3 sections. Each section 4ft, 22/6. 8ft long, 2 sections, 15/-.

BRAND NEW LEVER TYPE GREASE GUNS WORTH £4/19/6

59/6

Ideal for all types of Trucks, Tractors or Cars. 7500lb pressure.

IN FIRST-CLASS ORDER DALTON COMPUTERS. IDEAL FOR AERO CLUB. 45/-

SPECIAL SPECIAL

Stirrup Pumps, all brass, ideal for fruit tree spraying. Worth £4/15/-. 52/6.

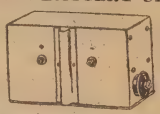
SURPLUS

512 Elizabeth St., Melbourne, C.1.
Phone: FJ5904. Just 4 doo

Mail Orders Carefully Packe
Please add Freight or Postage

COMPLETE BATTERY CHARGER

Fitted with Brand New English Selenium Rectifier.



Works off 230v. Household Supply.

Charges any battery, 6 volts at 4 amps, £6/15/- complete. Also available, 6 or 12 volt Charger combined. Charges 4 amps, £7/15/-. Brand new 6 volt, 3 amp. Chargers, complete, £5/15/-.

Not secondhand. BRAND NEW ENGLISH G.E.C. RECTIFIERS

Make yourself a Battery Charger.

12v 2 amp .. 32/6
6v 5 amp .. 50/-
12v 3 amp .. 45/-
6v 2 amp .. 24/6
6v 4 amp .. 45/-
12v 5 amp .. 79/6

Transformers to suit above Rectifiers. 2 amps, 37/6; 6 volt, 5 amp, 45/-; 12 volt, 5 amps, 55/-.

RAAF VARIABLE RHEOSTATS

2 OHMS
100 WATTS
IDEAL FOR BATTERY CHARGERS.

15/-

EACH

Ideal for control of motors, Electric Trains, Lights, etc.

At last the spotlight you have been waiting for

Ideal for Fox or Rabbit Shooting

Fitted with genuine American sealed beam globes. No motorist or boat owner should be without one.

6 Volt, 90/-; 12 Volt, 95/-. Complete with Switch and Flex.

AMERICAN VACUUM or AIR PUMP

Builds up air pressure to 20lb at 1000 R.P.M. develops up to 120lb of hydraulic pressure; will pump 7½ gallons S.A.E. oil or other liquids per minute. Useful for spraying, milking, presses, oil burners, hydraulic systems, £3/10/-.

Spray YOUR C... TOYS, HOBBI... FURNITURE

52/6

Spray from yo... Spare Tyre. An ideal Tool ... touching up damaged paintwork. Will spray Lacq... Paint, Enamel

24-VOLT MOTOR COMPLETE With Fuel Pump

Ideal for Caravans. Takes the place of Hand Pumps.

£5

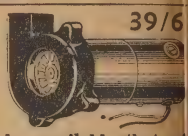
Each.

Many uses on the Farm... Will Transf... Petrol or Any Liquid from Drums etc. Will work from 24 or 32 volts AC or DC.

English Motor and Blower, 24 volts.

Will work off any Lighting Plant.

39/6



Large size also available that wi... work off 12 or 24 volts, £3/15/-

SPECIAL DISPOSALS METER OFFER

0-3 amp mete... AC-DC, 2½in di... 45

0/1 milliamp, 2½in dial ... 37
Weston 0-50 ... vo...
0-100 amps. com... bined M/coil, £3/10/-

English 50-0-50 Ammeters, M/coil 37/
English 0-50 Ammeters, AC-DC ... 42/
English 0-40 Voltmeter, M/coil ... 25/
English 0-300 AC-DC Voltmeters ... 55/
English 0-5 Milliammeters, 2½in ... 27/
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English 0-10 Ammeters, 2½in dial, Moving Coil ... 45/
English 0-30 Voltmeters, 2½in dial, AC-DC ... 42/
English 0-40 Ammeters, 2½in dial, AC-DC ... 42/
English 0-30 Ammeters, 2½in dial, AC-DC ... 45/
English 0-150 Voltmeter, 3in dial, Moving Coil ... 39/
Eng., 0-500 Micro Ammeter, M/coil 37/
Eng. 0-20 amps, 2in dial, M/c. ... 25/
Eng. 0-1½ Milliamps, 2in dial, M/c. 19/
Eng. 0-200 Ammeter, M/coil ... £4/10/
Eng. 20-0-20 Ammeter, M/coil ... 37/
Eng. 0-30 Amps AC-DC 2½in dial ... 42/
Eng. 0-50 Amps AC-DC 3½in dial 75/
Eng. 0-80 Amps AC-DC 3½in dial 75/
Eng. 0-1 Amps DC 2½in dial ... 35/
Eng. 0-5 Ampmeter AC-DC 2½in dial 45/
Eng. 200 Amps AC-DC 3½in ... £4/19/

ARMY FOCUSING TELESCOPE

Easily converted for use on dump... levels. Can be used as a rifle sight... Excellent magnification ... £4/19/-

Fitted with cross hair...

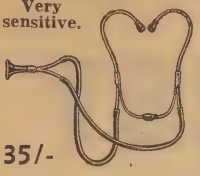
ADJUSTABLE FOCUS...

STORES

512 Elizabeth St., Melbourne, C.1.
m Victoria Street. Phone FJ5904

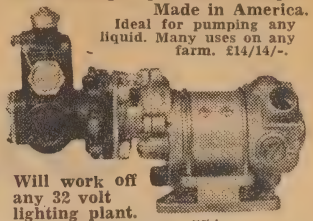
d Efficiently Despatched
Include State in Address

MECHANICS' STETHOSCOPES
Ideal for Testing Engines, etc.
Very sensitive.



35/-

Aircraft 24 volts Motor complete with 400 gal. per hour Pump.
Made in America.
Ideal for pumping any liquid. Many uses on any farm. £14/14/-.



Will work off any 32 volt lighting plant.
Pump only, 55/-.

INOCULARS. BRAND NEW. VERY POWERFUL

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solid
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£7/15/-

ed with High Class Ground Lenses.

R.A.F. LEATHER FLYING HELMETS, 50/- each.

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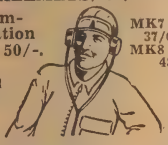
bes 50/-.



MK7 Goggles 37/6 Pair.
MK8 Goggles 48/6.

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ggles
3

WOOL LINED FLYING BOOTS.
£5/19/6 pr.

BRAND NEW STUDENTS' MICROSCOPES

t a toy.
real
lcroscope.
ours of
joyment
r any boy
girl
udent.

300 magnifications.

84/-

est slide included in nice box.

WATCHMAKERS AND INSTRUMENT MAKERS

nglish Tweezers .. .. .. 6/6 and 5/6
yeglasses .. .. .. 6/6 and 8/6
xtra strong double lens Eyeglasses 15/-
rewdrivers, set of five 13/9

Brand New American Wobble Pump, semi-rotary.

PHOSPHOR BRONZE VANES

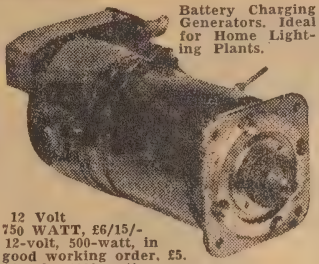
ntinuous
w,
/19/6.

leal for caravans, emptying or filling etrol tanks, watertanks, etc.

ENGLISH ARMY SPOTLIGHTS

IDEAL FOR SHOOTING FIT ONE TO YOUR CAR.

6-volt, 37/6
12-volt, 25/-
Fitted with Mirror Reflector.

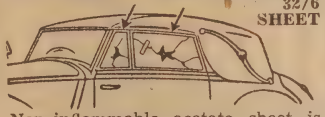


Battery Charging Generators. Ideal for Home Lighting Plants.

12 Volt
750 WATT, £6/15/-
12-volt, 500-watt, in good working order, £5.
24-volt, 1000-watt £9/10/-

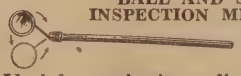
200 amp Generator. Ideal for welding. Made in America. Brand new £40

Replace those broken side curtains with cellulose acetate which takes the place of celluloid and lasts four times longer. Will not discolor. 32/6 SHEET



Non-inflammable acetate sheet is recommended for all types of side curtains. Sheets are 20 thousandths of 1 inch thick. Size of sheet, 24in x 52in. Can be sewn or cemented into frames

BALL AND SOCKET INSPECTION MIRRORS



8/9

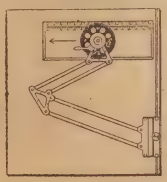
Ideal for mechanics, radio repairs.

ARMY SPOTTING TELESCOPES
Many uses on the farm. Ideal for Sheep Spotting.

Useful on the rifle range, 3 draw 17in long, 6in closed, 1in object lens, 18 magnification. Made in England £7/19/6

AIR FORCE PLOTTING BOARD

Ideal for use as Students' drawing board.



25/- Complete

Complete with Drawing Arm.

SPECIAL OFFERS FROM OUR NEW MOTOR ACCESSORY DEPARTMENT

American Shrader tyre pumps, work from your spark plugs, **39/6.** Car type fire extinguisher. Every car should carry one. Cost £7/10/-, **£4/10/-.** Steel mechanics' tool boxes, **19/6.** Brand new 7/8in spark plugs, suit most old type cars, **2/6,** or ideal for tractors. S.A.E. or Whit. Spanner Sets, open one end, ringed the other, 6 spanners to set, **23/6.** Army steel tow ropes, looped ends, **17/6.** S.A.E. open end spanners, 6 to set, **24/6.** Whitworth, 4 to set, **18/6.** Whit socket sets, **13/6** set. Mudguard type rear view mirrors, **16/6.** Inside car rear view mirrors, **4/11.** S.A.E. socket sets, **15/-.** Stick on type ash trays, **4/-.** Engineer's pliers, **4/6.** Car jacks, **37/6.** Tyre levers, **3/10** each. Hydraulic 2-ton jacks, **£4/15/-.** 6-volt windscreen wipers, **£4/12/6.** 12-volt **£4/19/6.** Car pumps, **14/-.** Shifting Spanners 4in **6/9;** 6in **8/-;** 8in **10/-;** 10in, **11/-;** 12in, **18/6.** Metric Socket Set, complete with bar, **59/6.** Feeler Gauges, **4/6.** Tail Lights, **5/9;** 12in Steel Rulers, **3/6,** 6in, **2/6.** Set of 3 Screwdrivers, **2/6.** Hydrometers, **11/6.** Piston Ring Compressors, **15/-.** Pressure Oil Cans, **9/6.** Combination Pliers, **5/6.** Multi Grips, **10/6.** Car Amp Meters, **15/6.** 4½in saw blades complete with arbor, ideal for making saw bench with electric drill, **25/-.** Bell-ringing generators, ideal for telephones, **25/-.** German Army marching compasses, work similar to prismatic, **32/6.** 110 volt 1000 watt projector globes, **32/6.** ¼in Black and Decker 230 volt electric drills, **£11/15/-.** ½in, **£24/8/3.** Magnifying Glasses, 8 mags., **8/6.** 10 magnifications, **12/6.** 24 volt motor and hydraulic pump, capacity 3½ gals. per minute, **£3/15/-.** New headphones suitable for crystal sets, **17/6 pair.** Army Mosquito Nets, ideal camping, **27/6.** Genuine RAAF Berets, **10/6.** Tapped Transformers, 6, 12, 18 and 24 volts, 3 amps, **39/6.** 230 volts input. Brand new American Cutting and Welding Torches **£4/4/-** complete. Army Slouch Hats in good order, **19/6.** Generator Test Meters, 35-0-35 amp meters, 4½in dial, **45/-.** 0-10 volt meters, 4½in dial, **45/-.** Loading Resistors can be supplied to make meter read 10.20 at **12/6.** Medical Scalpels, many uses, photographers, etc., **6/6.** Motorist Clip-on Trouble Lights with magnified bull's-eye lens, 6 volt, **7/6;** 12 volt, **6/6.**

The BEST

MINIATURE

RECTIFIER

at NO extra COST

350 volts at **90** milliamperes D.C.

PHILIPS

"Miniwatt" 6V4

INNOVAL Type 6V4

An indirectly heated miniature rectifier designed to meet the requirements of modern multi valve equipment, offering as it does the highest output current of any miniature rectifier. For equipment requiring less current, the added safety factor is of real value.

For full data and characteristics apply to your nearest Philips branch.

PV12A-55

PHILIPS ELECTRICAL INDUSTRIES PTY. LIMITED — — — Sydney, Melbourne, Adelaide, Brisbane, Perth

FROM THE SERVICEMAN WHO TELLS

(Continued from Page 63)

1 had been soldered to the chas-
In addition one of the lugs was
ving as an earth point for the
V7; the central shield, the cathode,
the filament all being returned
this point through a common
e.

his was all very well—except
both the negative lugs were
ding only intermittent connection
the chassis, both being classic
mples of a dry joint.

s a result the second filter con-
ser was earthed through the six-
filament winding, thus injecting
volts AC into the HT line. In
ition, the 6AN7 was rendered
perative by reason of its open
ode circuit.

ittle wonder that all it would
was hum.

ome emery cloth, a little paste
, and a really hot soldering
1 soon rectified this state of af-
s and the set was as good as
v. The owner was particularly
ased to learn that a definite fault
been discovered and that I
ld give him assurance that the
uble would not occur again. Ap-
ently it had been getting him
vn.

OOD AS NEW

hese two dry joints raise a
her interesting point regarding
mmercial wiring practice. The
of steel chassis and the solder-
of appropriate connections dir-
y to them is standard commer-
practice—and there can be no
rrel with it provided it is done
perly.

However, that qualifying state-
nt "provided it is done properly",
important because there are a
nber of reasons why such joints
frequently not "done proper-

The majority of soldered joints
a set involve only small masses
metal, in most cases already tin-
d. As a result a lightweight iron
d a minimum of low activity flux
all that is required to make a
iable joint.

By contrast a chassis joint is a
od deal more difficult. The very
ch larger mass of the chassis
es a problem, since the ordinary
or 75 watt iron is really in-
equate for the job. It is not
ways fully appreciated, even by
perienced solderers, that the pur-
e of the iron is to raise the
nperature of the job to the point
ere it (the job) will melt the
der.

Unless this requirement is ful-
ed, the solder will not flow into
pores of the metal and a re-
ble joint is impossible. To
ieve this a larger than normal
n is necessary and should be
d for all such joints.

In addition, steel is notoriously
rder to solder than copper or
ss, plus the fact that it is not
esented to the operator already
ned. On the contrary, it is usu-
y covered with a coat of lacquer,
ich is certainly no help.

First job, therefore, is to clean
metal with some abrasive to
move the lacquer and natural
oxides. Then, because steel is harder to solder, it needs a more active flux than the resin used in cored solder. The activated resins which are becoming more popular are better, but by no means ideal.

The paste type fluxes appear to be the best proposition, and the fact that they are more corrosive than may be desirable for fine wires is of little consequence where a chassis joint is involved.

All this adds up to the need for a somewhat specialised approach to the making of chassis joints in factory production. The operator who is to make these joints must be supplied with a heavy duty iron, means of cleaning the job, and a suitable flux; as well he should have some skill over and above those who have never joined anything larger than a resistor pigtail and a solder lug.

Most factories do, in fact, approach the problem in this way, but it is not surprising if, on odd occasions, all these special requirements prove too much for the operator and one or two dry joints slip through.

Of course, it shouldn't happen or, if it does, it should be picked up in the inspection department. But operators, and inspectors, are only human, so that an occasional faulty joint gets into the field. It is just as well that it is only occasionally because, when it does, it can cause plenty of trouble.

Thrust spoiler

A NEW device produced by the General Electric Co.'s jet engine department, and known as the "thrust spoiler" is expected to provide greater control of jet planes during landing and thus increase the safety factor.

The device is quite simple to instal and service and functions by deflecting the gases before they reach the exhaust nozzle. It is thus possible to keep the motor running at full power in case of emergency and to apply this full power without delay should it be needed. This is much safer than having to wait for an idling motor to come up to full power.

X-RAY SHOWS ENGINE IN MOTION

(Continued from Page 13)

beam, the crystal emits visible light. If the flat faces of the crystal are perpendicular to the x-ray beam a visible replica of the x-ray image may be observed along the beam axis. When the pattern amplifier is used in conjunction with a high-intensity, high-energy x-ray source such as the NBS 180 Mev synchrotron, it can continuously display images of parts hidden by as much as 18in of steel or 7½ft of concrete.

The visual image may be detected in several ways. It may be observed directly by eye, photographed with an ordinary camera, or observed with a remotely controlled television camera.

NEW AMERICAN TELEPHONE WIRE CLEARANCE

Rubber-insulated with stainless steel and copper conductors supplied on metal reels each containing half a mile of wire.

½-mile reels were 37/6 NOW 20/- Post Extra

In case lots—6 reels (3 miles) were £10/-/- NOW £5/5/- F.O.R.

NEW 5 VALVE D.W. BATTERY CHASSIS

This D.W. battery mantel chassis which is made by leading manufacturer is fitted with heavy duty Rola 6in speaker, tone control, etc., and gives excellent reception on local, interstate and overseas stations. Ideal for building into existing furniture, boats, caravans, etc. Valves used—two 1T4, one 1R5, one 1S5, one 3V4.

£5/17/-

NEW VALVES CAN BE SUPPLIED AT £3/10/- EXTRA

Postage and packing on chassis extra. NSW 17/6, interstate 25/-.

MIDGET GENEMOTOR

Input 28 to 32v at 1.1 amp. Output. 250v. at 60MA. New in carton.

£2/5/-

Used but in good order.

£1/10/-

Postage extra.

Input filter supplied with genemotors

28 volt GENEMOTOR

Input 28 to 32v. Output 250v at 65mA. Used but AS NEW.

£1/5/-

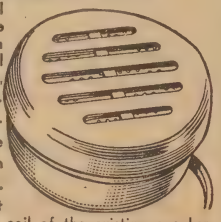
POSTAGE EXTRA

NSW 5/-, Insterstate 11/-.

—WANTED—

TEST EQUIPMENT, COMMUNICATIONS RECEIVERS, SURPLUS STOCK, ETC. HIGHEST PRICES GIVEN.

PILLO-FONE EXTENSION UNIT



It's a real miniature with Rola unit. Install it anywhere, in the sick-room, workshop, garage or any room in the house. Just connect across voice coil of the existing speaker. The "PILLO-FONE" IS THE MOST CONVENIENT LITTLE UNIT YET DEVISED. 3½in Diameter by 1¾in deep.

NOW 17/6

PLUS POST

CREED RELAYS

New Creed relays complete with original cartons.

£3/10/-

Special price for quantities.

TELESCOPIC AERIALS

These new all-brass 108 aerials measure 13 inches and extend to 4ft 3 inches in five sections. .. 17/6

Bakelite mounting base for above 4/6

Plus Postage

24-VOLT MIDGET MOTORS SHUNT WOUND

Fully Laminated Fields, Wound Armature. May be operated from AC at a slightly higher voltage. Sixteen Segment Commutator, ball-bearing Armature. Ideal for Model Trains, Hobbyists, etc. Condition New.

Price, each 39/6

Packing and postage: NSW 1/6; Interstate 2/6.

FOR CONSISTENT LOW PRICES ON ALL DISPOSAL AND SURPLUS EQUIPMENT

METROPOLITAN RADIO SUPPLIES

640 KING STREET, ST. PETERS, N.S.W.
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EW 5in AND 6in PERMAG SPEAKERS BY LEADING MANUFACTURER

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5F) 5in HEAVY-DUTY 29/6
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Available with 10T or 7T Transformer

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NEW "VELVET-ACTION" RECORD CHANGERS BY STROMBERG-CARLSON

Latest Model at almost ½ price

Model 104—Three speed automatic plays all microgroove and standard records — In original cartons £14/17/6 F.O.R.

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out 6V. output 230V. at 50 MA. These its made by A.W.A. are free from hum hash. Supplied complete with standard nchronous vibrator. **£3/15/0** F.O.R.

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.W.A. standard six pin syn- hronous vibrators in original artons 12 volts. Half price.
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1T4	11/6	VR105	15/0
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6SA7	10/6	955	7/6
6SQ7	10/6	9001	7/6
6SN7	10/6	9004	7/6
6SL7	10/6	717A	7/6
6AG7	10/6	7C5	7/6
6AC7	10/6	EF50	7/6
6AG5	12/6	12SR7	2/6
6J7G	10/6	1K5	2/6
6K7G	7/6	VR65A	2/6
6J6	15/0	12SQ7	2/6
EL33	12/6	6SH7	7/6
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ALL PLUS POSTAGE

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Colour-Code
Card-Supplied

Well-known make of carbon resistors in values of 100 ohms to 5 megohm. In 1-watt, ½-watt and 1/3-watt. All resistors are standard color coded and in original cartons. In lots of 100 mixed values comprising 50 1-watt, 25 ½-watt 25 1/3-watt.
Price **8/6**
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New midget power trans. Upright mounting with cover plates. 240v. Pri. Sec. 225 x 225 at 50 Mill. and 6.3V. at 3 AMP.
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Transmitting Valves

866	15/0	1616	£1/10/0
832	£2/0/0	828	£2/10/0
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I.R.C. carbon resistors, ½, 1 & 2 watt. in values 50 ohm to 5 meg. including many popular sizes, 3T, 15T, 20T, 25T, 50T, 100T, 250T, 500T, etc.
(Standard resistor color code supplied).
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6 volt A.W.A. gas-filled vibrators. Heavy duty synchronous
NOW 7/6 or 70/- per doz

NEW 1T4 BATTERY VALVE
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Rothermel high fidelity pick-up cartridge. Replacement for most pick-ups. **7/6 ea.**
ACOS Cartridges 10/-

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Rothermel sapphire needles play 2,000 recordings. Made in England. **3/9 or 30/- doz.**

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7in Dynamic speakers by leading manufacturer,
1,500 ohm Field coil,
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or
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9in x 6in. 1,000 ohm Field, 5,000 or 7,000 ohm Transformer
NOW 20/- EACH
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NEW H.F. TRANSCEIVERS

RT 34-APS 13C (Tail-end-Charlie) Freq. 420 mcs. contain 16 valves 9-6AG5, 5-6J6, VR150 and 2.2D2. Also midget 24v Genemotor.

Less valves—£5/-/- **£10**

FULLAPHONES

Containing pair headphones, morse-key buzzer, key switches, etc., **20/-**

Post NSW 6/6 F.O.R. Interstate 8/6

NEW H.F. RECEIVER—R3118

(RESPONSE UNIT)

The ideal receiver for the 144 M.C. Band uses 13 6.3v valves, including two tuned R.F. stages. Supplied complete with valves, plugs and A.C. power supply. (240v.)

£9/17/6 F.O.R.

ENGLISH I.F.F. MOTOR

English I.F.F. motor complete with gearbox. 18v D.C. operation but suitable for conversion to A.C.

Were £2/10/-, Now 37/6

Postage extra — N.S.W. 5/- Inter., 8/6

75 ohm CO-AXIAL CABLE

75 ohm Coaxial Cable 1/9 per yd. Minimum quantity 10 yards on drums each containing 110 yards. £7/10/-. F.O.R. Co-Ax. Plugs & Sockets (Pye Type) 3/- Pr. American type 4/- pr.

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Suitable for conversion to A.C. motor (approx. one sixth H.P.) Fully laminated. Can be used as 6 or 12 volt generator at 20 or 13 amps £2/17/6 f.o.r.

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A.T.5. Transmitter covering 140 K.C. to 20 M.C. in two separate tuned circuits. Provision for crystals. Complete with valves. Three 807 and two 6V6.

£4/17/6 F.O.R.

A.C. AMP METERS

A.C. Amp Meters (ex-Country Council). A necessity in any electrical workshop.

RANGE. 0-5 amps. (can be extended by shunts).

MOVEMENT. 300 degrees.

SCALE LENGTH. Nearly 15 inches.

DIAMETER. 7½ inches. **28/6**

Postage extra — N.S.W., 6/6 — Interstate, 11/6.

£8/15/- F.O.R.

NEW AMERICAN INDICATOR-UNIT

These indicator units contain the following valves:

Six 6SN7GT, one 6G6, one 6H6, one 6X5GT, one 2X2, and 3BP1 C.R.O. tube which is fitted in a separate shield on a 4ft shielded lead and supplied with control box and plug; case and shield are finished in black brocade. In original cartons.

TRANSFORMER TO CONVERT THIS UNIT FOR 240 VOLT OPERATION AVAILABLE AT £3/15/- EXTRA plus postage.

A.M.R. 300

COMMUNICATION RECEIVER

This first class 10-valve receiver made by S.T.C. has a band spread coverage of 1.5 to 24 mcs in switched bands—240v AC operation—supplied complete with valves, crystal, S meter & speaker, air tested. **£47/10/-** F.O.R.

New 12 volt vibrator supply for above complete with leads, spare valve and vibrator 3-6 x 5 & 2 vibrators. **£5/15/-** F.O.R.

OIL FILLED CONDENSERS

(Working voltages stated)

20mfd. tapped	600v.	17/6
2mfd.	1,750v.	12/6
3mfd.	2,000v.	17/6
4mfd.	500v.	6/6
4mfd.	200v.	4/6
8mfd.	400v.	8/6
.5mfd.	200v.	2/9
.25mfd.	750v.	2/9
.01mfd.	3,000v.	5/-

(all above plus postage)

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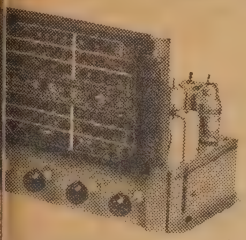
EW RADIOGRAM - CHASSIS KIT - SETS

5 VALVE DUAL-WAVE

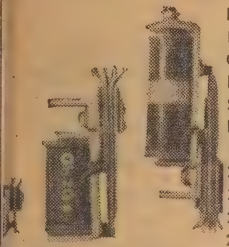


Complete kit of parts including 12in Magnavox or Jensen Speaker, five valves (1 6J8, 1 6K7, 1 6SQ7, 1 6V6 and 1 6X5) and all other parts to the last nut and bolt to complete the five valve dual wave chassis illustrated.

These chassis when completed give excellent overseas, local and interstate reception as the coils supplied and intermediate transformers are high gain Permatune iron cored. Pick-up switch and volume control with A.C. switch supplied. Suitable for use with any crystal or high impedence magnetic pick-up.

LIST PRICE OF PARTS £25 SPECIAL PRICE £14/17/6 F.O.R.

. WIRED - AND - TESTED £2/-/- EXTRA



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). 1 Miniature relay 300 ohm
il, S.P.D.T. contacts, 10/-
). 2 Standard relay 250 x
0 ohm coil 4 pole S.T. 7/6
pole S.T. 6/6
). 3 Standard relay, 15,000
m coil, 2 pole D.T. 12/6
All relays suitable for rewinding.

New dynamic mike inserts	8/6
Bakelight fuse boxes	4/6
Carbon mike transformers	3/9
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Shielded hook-up wire, per yd.	8
Morse keys	4/6
12v 400 watt prefocus globes	7/6
3 gang standard condenser	18/6
3 gang midget condenser	18/6
2 gang standard condenser	15/-
2 gang midget condenser	15/-
26-pin plug and socket	5/-
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Lifeboat transmitters	22/6
Teletron octal sockets, doz.	3/6
9-pin loctal sockets, doz.	5/-
6-pin wafer sockets, doz.	3/-
5-pin ceramic sockets, ea.	2/-
Acorn sockets, ceramic, ea.	3/6

RELAY-TYPE COUNTERS

("Mercury" American Made) These relay counters register from 0 to 99,999. Can be supplied with 250ohm, 500ohm or 5,000ohm coils.

29/6

plus postage

P.M.G. TYPE RELAY-COUNTER

0—9,999.
1,300 ohm coil **22/6**

50-CYCLE A.C. AMMETERS

29/6

PLUS POSTAGE

Range 0-5 Amps.
Scale Size 9in Dia.

Price, each.

37/6

Packing and postage: NSW, 7/6; Interstate, 12/6.

AMERICAN ANTENNA SWITCHING MOTORS

mplete with 8 Pye-Type Co-ax Bases, R.P.M. 1750, Ball ring, 24 Volt.

D.C. GENERATORS

/ 500 watt, Ideal Home lighting, Battery charging, etc.

Price £3/10/- F.O.R.

TRICKLE-CHARGER KITS

; for trickle-charger as described in R. & H., June issue.
mprising transformer with 18V winding tapped at 12V-3
mA rectifiers and 50 ohms control.
tage: NSW, 5/-;
erstate, 7/6

39/6

PEDAL-GENERATING SETS

These units in new condition will generate 12 volt at 5 amp. or 6 volt at 8 amp. Could be motorised if required. Complete with generator, reduction gear, stand, meter (3in) etc.

£8/17/6 F.O.R.

NYLEX HOOK-UP WIRE AT HALF PRICE

Nylex hook-up wire 10/.010 in 100 yard coils, each coil consisting of five 20 yard lengths in 5 different colours. **10/- PER 100 YDS.** Plus postage.

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479 PARRAMATTA ROAD,
LEICHHARDT, NSW. PHONE LM3610

ANSWERS TO CORRESPONDENTS

D. (Bowden, SA) sends us a fur-2 months' subscription and com- on some of the articles published past 12 months. The articles on mic music are among those found interesting. He also expresses the n that the coming electronic age roduce some startling developments. lo sends us a couple of stories for rviceman as well as some very nice ents on these articles.

Many thanks for your subscription, , and we are very glad to learn ou find the magazine so interesting iformative. As you say it is likely ve are on the threshold of some ng electronic developments, many ich have already been visualised merely require the necessary re- to bring them into practical use. ver, if we may be permitted to an open mind, we would point out ost competent authorities cast con- ble doubt on the accuracy of the ients contained "Flying saucers landed". On the other hand the itself can be quite convincing and difficult to say just where fact ceases fiction takes over. Many thanks for your contributions to the Ser- an and we will pass these on to- with your kind comments.

E. (Lilydale, V.) wants to know can fit AVC to the SW Converter bed in the July, 1955, Radio, Tele- and Hobbies.

It should be possible to extend the system of the main receiver to the tage of this converter without too difficulty. The earthy end of the coils would be disconnected from hassis and connected to the AVC The junction would be by-passed ssis with a .05 capacitor and con- on made to the existing AVC line gh a decoupling resistor of about gohm.

. (Roseville Chase, NSW) wants to if we have a wiring diagram for Set For Young DXer's described in October, 1954, issue.

Sorry, D.S., but we do not produce g diagrams unless for publication. involve a lot of work and there point in producing them unless tend publishing them. This means, tunately, that we cannot help you his matter since we have no data than that which has already been shed. We can only suggest that one our pamphlets on circuit symbols be of help to you to follow the al circuit diagram which, once you he hang of it, is really a lot easier e than the wiring diagram. This is able through our query service /-.

.H. (Meredin) is a keen reader of , Television and Hobbies and has one of the smaller receivers which es with a car aerial mounted in- . With this simple set-up he has ved many interstate stations. He also built the Junior Multi-meter of ember, 1954, with considerable suc-

Many thanks for your letter, J.R.H., we are glad to learn that you have so much success with your various cts. It is truly remarkable what be done with some of the simpler s of receivers when they are handled ctly and they provide considerable est and training.

deG. (Claremont, WA) has a problem is hands in the form of a receiver as built for 32V operation. To ob- the required HT, he bought a 240V converter, and would like to know to connect it up to the set. It has tandard power supply.

We are afraid, M.deG., there is no way out of your problem. Your erter actually supplies 240V AC, and ould be necessary to provide the set a normal AC power supply in order nake it work properly. However, s in this set-up would be considera- and may place too much drain on battery bank. It would have been easier to wire the filaments in a series-parallel arrangement, making sure, that all filaments receive their correct voltage and current, and connect them across 32 volts. DC HT could be supplied from a 32V vibrator supply. If this is too expensive to do now, the only thing to do would be to obtain a standard power transformer for 240V AC, and a suitable rectifier, and operate the set as a normal AC receiver.

N.R. (Georgetown, SA) would like to know if it is possible to use a two or three-gang tuning capacitor with a one-valve set. When he tried to connect one up in his set, it would only tune one station all over the dial.

A. Standard tuning capacitors usually have a capacitance of approximately 450 pf, when fully closed, and most coils are designed to give optimum performance and coverage with this amount of maximum capacity. A two, or three-gang, tuning capacitor actually consists of three of these standard capacitors mounted on a common shaft. If one is on hand, it would therefore be possible to use it with a one-valve set, simply by connecting only one section into the circuit, and ignoring the other two. We have a faint suspicion, however, that you connected all three sections together. This would mean that you have 1350 pf in circuit, which would completely upset the performance. A one-valve set would have only one tuned circuit, and therefore only one gang section is required. Multiple gang tuning capacitors are normally only used with receivers having several tuned circuits, such as TRF sets, or superhets.

B.A.P. (Bartleigh, Vic.) sends in a request for a list of S/W call signs, transmitter wavelengths and locations.

A. Unfortunately, B.A.P., our only list of S/W stations appeared in the Short-wave Handbook, which has been out of print for some time. We have never published the data in other form except the references in Art Cushen's series of articles on S/W reception. We suggest that you look up copies of back issues, and refer to the articles in them.

R.E.L. (Theodore, Qld.) is at present studying for his AOCP examination and would like to join the WIA. He asks how he can go about it.

A. Your best proposition would be, R.E.L., to write to the secretary of the Queensland division of the WIA, Box 638J, GPO, Brisbane, who will be able to give all the details about joining the institute.

G.R.W. (Glen Innes, NSW) would like to see more about Radio Control of models in our magazine. He also states that commercial models, which are expensive, very rarely give more than one-mile range.

A. For a long time we have intended to publish some articles on radio control, but there are still difficulties to be overcome, before we can go ahead with publication. As regards range of control equipment, it is very doubtful if a range of over one mile can be realised, as such transmitters are limited by law to an output power of only 2 watts.

J.D. (Hobart, Tas.) sends in a circuit for a battery power supply for electric shavers. To get over the difficulty in obtaining a 50 c/s vibrator, he used a synchronous unit, driving the shaver with DC.

A. The idea is certainly very neat, J.D. We do not know of anybody who has used high voltage DC supply for shavers, although it is expressly stated on most models that they do work on DC. We have filed your diagram for possible future use in our Reader Built It Column.

F.J. (Windsor, NSW) has amplifier trouble, and as he is not yet familiar with the finer points of the game, he would like us to give some suggestions on how to cure "motorboating".

A. To start with, may we point out that it is very unwise to operate a push-pull amplifier with one of the output valves removed. Doing this removes a major part of the load from the rectifier, the voltage rises and the other valves may be subjected to voltages far in excess of their rating. The output from the other output valve will also rise, masking the effect of reduced power output and distortion, particularly at lower levels. Secondly, what is motoboating actually? Nothing more than instability, or oscillation, at a very low frequency, caused by feedback from the output valve into the early stages

(Continued on Page 127)

The Radio, Television and Hobbies Query Service

All queries concerning our designs, to which a POSTAL REPLY is required must be accompanied by a postal note or stamps to the value of TWO SHILLINGS.

For the same fee, we will give advice by mail on radio matters, provided the information can be drawn from general knowledge. UNDER NO CIRCUMSTANCES, however, can we undertake to answer problems involving special research, modification to commercial equipment or the preparation of special circuits.

Whatever the subject matter, we must work on the principle that a letter is too involved if the reply takes more than 10 minutes of our time.

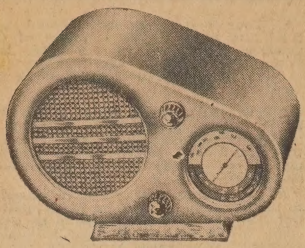
Queries not accompanied by the necessary fee will be answered FREE in the columns of the magazine and presented in such a way as to be of interest to other readers.

To those requiring only circuit reprints, &c., we will supply for TWO SHILLINGS diagrams and parts lists from our files covering up to three constructional projects. Scale blueprints showing the position of all holes and cut-outs in standard chassis can be supplied for 5/-. These are available for nearly all our designs but please note they do NOT show wiring details.

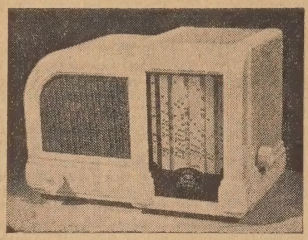
Address your letters to The Technical Editor, RADIO, TELEVISION and HOBBIES, Box 2728C, GPO, Sydney.

Note that we do not deal in radio components. Price quotations and details of merchandise must be obtained direct from our advertisers.

MOTOR SPARES LTD

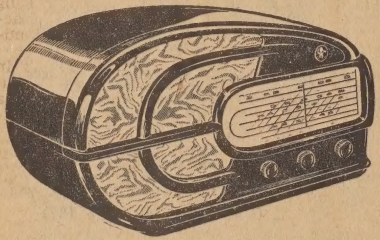


3 Valve AC Mantel, Colours Ivory, Pale Green, Burgundy, Pearl Grey and two Tone Ivory & Burgundy, Grey & Burgundy. Ideal for local reception, good tone and volume. 3 months guarantee. Price **£11/19/6.**



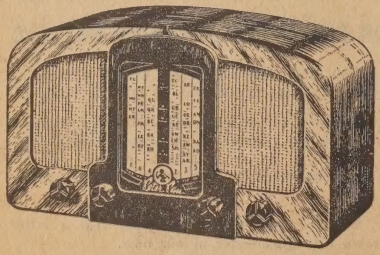
4 Valve Vibrator Mantel to work off 6 volt battery, low current drain and small size. Ivory or walnut bakelite case, ideal for caravans, boats or weekend shack, 3 months guarantee. Usual price 34 gns.

Our price 16 gns.



5 Valve Dual Wave Vibrator Mantel to work off 6 volt battery, low current drain, medium size, Walnut bakelite cabinet, long range tone control, 6 inch Rola speaker. An excellent set, with 3 months guarantee. Usual price £45.

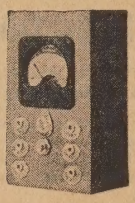
Our price £27/10/0.



Wooden Cabinets suitable for 4, 5 or 6 valve Mantel Radios with Vertical dial, beautifully finished in Walnut or Mahogany. Overall size 17in long, 7½in wide, 10½in high.

Worth £4/10/-

Our price **25/-** ea.



Chieftain Multimeter New model using 100 ohms, internal resistance meter sensitivity 1000 ohms per volt. Voltage readings 0-15, 0-150, 0-300, 0-600. DC Ohms 0-100,000. This is a pocket size meter, ideal for the Electrician serviceman, amateur, motor mechanic and handyman.

Price only £4/12/6

★ SPECIALS ★

1. **Heavy Duty Screw Terminals.** Nickel plated on brass. Excellent quality, new. Worth 4/6. **Our price 9d. each.**
2. **Coaxial Connectors.** Pairs of chassis mount female and angle type male connectors, all screw on fittings. Polystyrene insulation, ideal for H.F. work, brand new **only 4/6 pair.**
3. **4 mfd 750 wkg Block condensers,** brand new and perfect. A bargain at **5/9 each.** Special price for quantity on application.
4. **Germanium Diodes.** Ideal for Crystal Sets, rectifiers in meters and radio set detectors. **Brand new only 4/11.**
5. **0-1 ma Meters.** 100 ohms internal resistance. Sensitivity 1000 ohms per volt. Square face with 2 inch scale. An excellent meter for test equipment, multimeters, etc. **Only 32/6 ea.**
6. 0-1 ma Meter as above with multimeter scale. **Price 37/6.**
7. **Philips Transistors**
   Type OC 70 .. .. **37/10**
   OC 71 .. .. **37/10**
   OC 72 **£5/0/3 pair or £2/10/6 ea.**
8. **PE 94A** Genemotors. Input 28 volts. Output 300 volt DC at 260 ma,
   150 volt DC at 10 ma,
   16 volt DC at 5 amps,
   Enclosed in metal box with cooling fan, voltage regulator and filter; can be converted to 32 volt motor if desired. **Price only 25/-.**
9. **Standard Shielded Coils.** Broadcast RF Coils, Iron cored, brand new and boxed. **3/6 each.**
   Broadcast Osc. Coils to suit 6A8G, 6J8G, ECH35, 6AN7:—
   Iron Cored, 4/6 ea.
   Air cored, 3/6 ea.
   Unshielded Short Wave Coils, 1/- ea.
   Aer. Osc. RF.
10. **BC345 Switch Box.** Size of box 3½ x 3 x 1¼in. Parts used 1-2 Pole 3 position. Wafer switch with metal pointer knobs, 2 phone jacks single circuit type. 1-8 pin plug and socket. **Price only 4/6 ea.** Incomplete, lower part of box and female section of 6 pin socket missing. **Price only 3/6 each.**
11. .001 Mica Condensers, 10,000 volts, **5/- each.**
12. .01—5000 volt wkg condensers, **5/6 ea.**
13. .02—10,000 volt wkg condensers, **7/6 each.**
14. .5—5000 volt condensers, **5/9 each.**
15. Output transformers, new, well known make 10,000 ohms CT to 2.3, **5/6 each.**
16. 50,000 ohm wire wound Potentiometers with calibrated control knob. **5/9 each.**
17. ½ meg Pot. with double pole switch, English make brand new excellent quality. Worth 14/7. **Our price only 8/6 each.**
18. 1 pole 2 pos. Wafer Switches new. **1/6 each.**
19. Job Aerial Wire Waterproof 100ft. **5/- each.**
20. **Well known Brand of Speakers.** 6½ inch Permag with 5000 ohm transformer. New and Boxed, **35/- each.** 7 inch Permag. with 10,000 ohm transformer. New and Boxed, **35/- each.**
21. **Metal Cases** overall size 13 3/8in. long 11in. high 5¾in. wide, with rounded edges. Nickel plated hinges and catch, leather carrying handle. Ideal for suitcase also suitable for instruments portable radio etc., metal front panel and chassis and separate battery compartment in each case. **Price only 12/6.**

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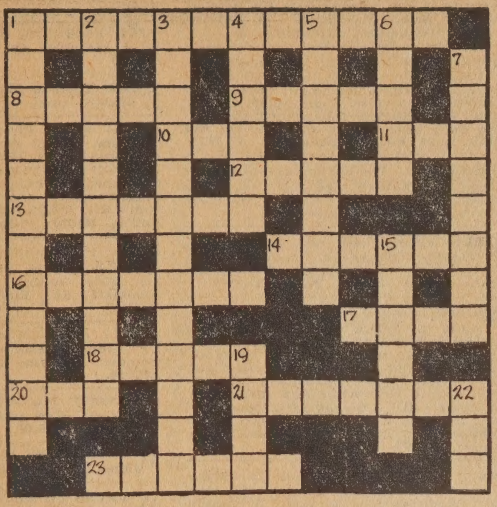
GEELONG MILDURA SHEPPARTON ST. ARNAUD WAGGA WANGARATTA WARRAGUL

THE R. & H. CROSSWORD No. 17



ACROSS

1. Reciprocal of reluctance.
8. Radio location.
9. Superintendent (slang abbrev.)
10. A tag or label.
11. Organ of hearing.
12. Positive electrode.
13. Allows interchange of certain valves.
14. To treat with heat.
16. Pertaining to nature.
17. Face.
18. —— coil.
20. Solid water.
21. To depart from original.
23. Electromagnetic switches.

DOWN

1. When a substance has high permeability.
2. Emitting radio rays.
3. Advantage on small receivers (2 words)
4. Used for wiring.
5. Type of coil winding.
6. Triple.
7. In shunt connection.
15. Phonograph pioneer.
19. Type of current.
22. Soldering end of an iron.

Solution and further crossword next month

ANSWERS TO CORRESPONDENTS

e amplifier. Any small signal, even itching noise, causes a small varia- in the voltage available from the ier. This variation is in turn con- d to the plates of the other valves, where it is amplified and fed back he output valves. To avoid this, ors are inserted into the HT line, ssed by large capacitors. These citors charge up and tend to equalise voltage applied to them by releas- ome of their charge, if the voltage or absorbing a higher voltage, the signal is prevented from reach- the early stages. If the capacity ese condensers, called "decoupling citors", is insufficient, some of the l may reach these stages, causing bility. Now the two output valves ice signals, one of which is in e with the input to the amplifier, other out of phase. Removing the output valve allows the out-of- e signal to reach the first stage, lly preventing instability. Remov- he second valve allows the in-phase l to be fed back and the amplifier s off". Instability, however, will take place, if the gain of the am- r the signal is fed back to is suffi- y high to produce a signal bigger the original signal at the grid of utput valve. This explains why the val of one particular valve cuts out motorboating, and also why the ifier will not motorboat with the ol unit disconnected. The remedy d be to check the decoupling capa- , if their capacity is high enough, to a combination of circumstances ay even be necessary to replace with higher values, particularly in control unit. The use of D/W kets in Playmaster tuners was con- ed, but rejected, because no suit- bracket could be obtained. How- quite good results can be obtained the front end of a D/W receiver, if wide band B/C reception is considered unnecessary.

E.E.A. (Deception Bay, Q.) writes to tell us that he is making the electric guitar described in the August, 1948, issue of R and H and asks if we have details of the one described in the August, 1941, issue.

A. We regret that issue requested is no longer available, neither are any reprints available. However, it may be possible to obtain a copy through your local technical library or by advertising in our "Wanted To Buy" columns.

G.C. (Springvale, Vic.) writes to tell us that he has had very good results with the Porta-Player and would like to know if it would be possible to make it into a tape recorder by adding the No. 2 Tape Adaptor described in the July, 1953, issue.

A. We are pleased to hear that you are pleased with the Porta-Player but it is not sensitive enough to be used with the Tape Adaptor and will require an additional stage in front of it. As regards the most suitable oscillator coil to use, we suggest that you contact the manufacturer of the particular heads that you intend to use.

R.J.H. (Carlton, N.3, Vic.) would like to extend his range of instruments by adding a small 455 Kc oscillator. He inquires if we intend publishing such a circuit in the near future, preferably using transistors.

A. If the number of inquiries warrant it, R.J.H., we may publish such a circuit in some future issue. However, it is not likely to use transistors for some time yet, as these devices, at least the ones available locally, do not have the required RF characteristics. Also, if one goes to the trouble of providing several calibration frequencies, it may be as well to cover the whole range of frequencies encountered in the servicing of broadcast receivers.

Last Month's Solution

READER BUILT IT

(Continued from Page 95)

The amount of expansion available is about 20db—more than is needed. The expansion is controlled by the 1 meg and .1 meg potentiometers. Advancing these together will increase the available expansion while maintaining the overall gain at about the same level.

With a little experiment these could probably be ganged, but I did not find it necessary to do so. The —50V. bias for the .1 meg pot. can be obtained from a separate power supply if necessary or from a "B" battery.

In my case it was obtained by sacrificing 50V. from the existing pre-amplifier power supply by placing a suitable resistor in the secondary centre-tap.

A little experience is necessary in the best setting of the controls, but I think the results fully justify a few hours of preliminary experimenting.

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WANTED TO BUY, SELL OR EXCHANG

Cost of Classified advertisements in this section is 2/- per line, approximately five words to a line. Closing date for October issue of Radio, Television and Hobbies is Wednesday, September 14.

FOR SALE: University multimeter £12, 1155A Recr 500 Kc to 18 Mcs. £25. Variety of meters 10/- each. Chokes and trannies 5/- to 10/-. Jap crystals 2-6 Mc range 7/6. Resistors and condensers, suitable ham transmitters. **O'Brien, 270 Old South Head Rd., Watsons Bay. FU2276.**

COACHING: Pre-examination tuition, morse, radio, electrical, licensing theory at your own home by qualified instructors. **Phone XW6256.**

SELL: Transmitters, receivers, meters, transformers, motors, valves, &c., at bargain prices. **Suburban Radios, 334 Charles St., N. Perth. Phone BA2395.**

ORGANS (Electronic). Do you want to build an organ or other electronic musical instrument? Contact us for help. We have a complete range of books on the subject, and can supply any parts you may require. We are particularly interested in having your name and address for our mailing list. See also our advertisement on page 55. **The Electronic Organ Company (Australia), 9-11 Cadow Street, Pymble, NSW.**

SELL: All back issues R. & H. Many early copies in stock, 4/- per copy, incl. post. Write now to **T. Weir, 73 Gibson Ave., Padstow,** for prompt service. **UY8056.**

SELL: Xtals 3.5 — 9 Mc. Many frequencies. Suit VHF Tx and Rx £1 each. **T. R. Naughton, Birchip, Vic.**

SELL: Printing, Special Offer:—100 Business or Visit Cards, 30/-; 100 Letterheads, 30/-; 200, £2. Sent anywhere by mail. Do it now! **W. Hiley, 841 George St., Sydney.**

FOR SALE: Byer T-39 16in Transcription Turntable, 78 & 33-1/3, as new, weight 75 lbs, cost trade, £160; offers or exchange tape recording equipment, **P.O. Box 1, Huonville, Tasmania.**

SALE: 10 used gangs, diff. shapes and sizes, £2 lot. Nova high speed tape recorder, meter level ind., new, £80. Pye model APM mantel radio, wooden cab., exc. order, £8. L.S enclosure portable + 8in Rola speaker, £6 or offer (after Radio and Television News, July, '53). 12 volts Vesta model A Battery, as new, £4. 4-6-12v Battery Charger, 4 amps., £3. Paton model VCT valve tester, no faults, £10. Rola 12 OX loudspeaker, new, £5/10/-. Philips EZ40 valves, 12/- each. Philips imported V/A meter, 330 ohms/volt, 6-30-150-300-600V AC and DC, 3-15-60-1500-6000 MA AC and DC, £5. Enquiries by letter or appointment only. **E. Bolsius, 46 Crown Rd., Queenscliffe, N.S.W.**

FOR SALE: UHF Portable Rotary Be... FJ2219. 3 Marville Av., Kings... Sydney.

FOR SALE: 130 R. & H., 1939 to... 3 Marville Av., Kingsford, Syd... FJ2219.

SALE: Thorens E53PA Trans. T. T... Hardly used. Offers. Ring LA...

SELL: R.C.S. Parts, Odd Stock. Price. TB 42 Audio Trans. 14/6. 43 Audio Trans. 14/6. TA 4 Audio c... 12/6. TC 58 L/T Viv. Choke 12/6. T... S/T speaker Trans. 6/- TS 25 ... Speaker Trans. 6/-. TS 26 PP/T Spe... Trans 6/-. TS 28 S/U Speaker Trans... **Collins Radio, Melbourne.**

SELL: Palec Multimeter, d/w brack... R.F.S., valves, parts, Stromberg-... son auto. record changer, cheap. **Moombie St., Summer Hill, Syd... UA1713.**

SELL: American omnigraph clock... code transmitter, booklet, ba... sounder. **Williams, 3 Pearce St., Caul... LF2754.**

WANTED: Mu Metal Shield 5BPI... No. 11. IFTS and BFO Coil. **S. G... Bowraville, N.S.W.**

WANTED: AR7 Manual and Rack... **Jones, 75 Campbell St., Newtown.**

WANTED TO BUY: A copy of "Wir... World" for February, 1953. **J. F... Box 20, Koroit, Victoria.**